JOINT STAFF WORKSHOP

BEFORE THE

CALIFORNIA ENERGY RESOURCES CONSERVATION

AND DEVELOPMENT COMMISSION

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In the Matter of:               )
                                )  Docket No.
CALIFORNIA STRATEGY TO REDUCE   )  01-SRPD-1
PETROLEUM DEPENDENCE            )
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CALIFORNIA ENERGY COMMISSION

1516 NINTH STREET

HEARING ROOM A

SACRAMENTO, CALIFORNIA

TUESDAY, FEBRUARY 26, 2002

9:43 A.M.

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COMMISSIONERS PRESENT

William J. Keese, Chairman

James D. Boyd

CEC STAFF PRESENT

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Daniel W. Fong, P.E., Transportation Technology Specialist, Transportation Technology and Fuels Office

Susan Bakker, Advisor

David Ashuckian

ALSO PRESENT

Michael D. Jackson, Associate Director,
 Transportation Technology,
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Acurex Environmental, An Arthur D. Little Company

Peter Berck
University of California Berkeley

Sergio C. Trindade, President
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American Lung Association of California

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ALSO PRESENT

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I N D E X

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P R O C E E D I N G S

9:43 a.m.

CHAIRMAN KEESE: I'd like to welcome everybody to this workshop. This workshop has increased in importance over the last few months.

I'd like especially to announce Mr. Jim Boyd's presence here as a Commissioner of the California Energy Commission. Jim most likely will be the Chair of the Fuels and Transportation Committee after the Commission's 10:00 meeting tomorrow morning, at which the suggestion will be that Mr. Boyd chair the Committee and I will remain number two on the Committee.

Assembly Bill 2076 directs the California Energy Commission and the California Air Resources Board to develop and submit to the Legislature a recommended strategy on ways to reduce petroleum dependence in California. This report is due to the Governor and the Legislature by April 30th of this year. We have much work still to be done to satisfy the legislative directive for this work.

One week ago today we held a workshop in this very hearing room to discuss the possible near-term impacts of the phase out of MTBE in gasoline. At that workshop our consultants laid out a scenario that adherence to the December 2002 phase-out schedule could result in a 5 to 10 percent gasoline shortfall, and a 50 to 100 percent increase in gasoline prices. That workshop set the stage for a short-term supply problem.

By contrast, this proceeding focuses on the demand side of the equation, exploring ways to use fuel more efficiently in the transportation sector while gradually transitioning to nonpetroleum and renewable fuels and advance efficient vehicle technolologies such as fuel cells, hybrids and advanced natural gas engines over the long term.

At the same time we are exploring short-term measures, such as the purchase of fuel efficient vehicles, use of low-rolling resistance tires, improving vehicle maintenance practices and new blends of gasoline and diesel fuel.

Today's staff workshop is the third in a series of joint staff workshops to develop a California strategy for reducing petroleum dependence. It represents an interim step in a comprehensive analytical effort by both agencies to select those strategies that have greatest potential impact on reduction of petroleum dependence in California.

Our discussion today will focus on the quantification of environmental or external benefits of reducing petroleum demand.

California's growing petroleum demand will increase the air quality, water quality and other multimedia impacts associated with petroleum use.

Today you will hear from staff and its consultants on ways to assign a dollar value on avoiding those impacts, including the health impacts of reduction in criteria pollutants, toxic air contaminants and carbon emissions.

The economic impacts to the California economy of reducing petroleum use will also be explored.

You will also be hearing from staff on the relative relationship of various fuel displacement and efficiency strategies in terms of their costs to consumers and to government; their relative petroleum reduction impacts; and the timing of short- and long-term measures.

I would suggest that everybody in this

room recognize the interconnection between the four studies that the Commission is working at at this time: Petroleum dependence; MTBE conversion; fuel reserve; and alternative pipeline into California. They all are interrelated in this general issue.

We, Commissioner Boyd and I, strongly encourage your active participation in these proceedings, and look forward to a constructive dialogue so that we can meet our April 30, 2002 deadline.

Thank you very much for joining us.

MS. BROWN: Thank you very much, Chairman Keese. My job is to sort of set up the day's agenda, and I want to say a few words about again reminding us all about the legislative requirements of AB-2076.

There are really three parts of the legislation. One is to recommend a strategy for displacing petroleum use, particularly gasoline and diesel use.

Second is to develop a forecast of gasoline and diesel demand, which is, by the way, something we've already completed. It is on our website. The demand forecast for both 2010, 2020, and we've actually extended the analysis out to 2030 at the request of Assemblyman Shelley.

And lastly, to set measurable statewide goals for reducing petroleum use.

As Chairman Keese has already mentioned the report is due by April of this year to both Governor and the Legislature.

The legislation actually arose out of a concern raised by the Attorney General's Office on price volatility affecting gasoline. And specifically mentions that we address transportation energy efficiency; advanced transportation technologies; the increased use of nonpetroleum fuels as a way of displacing petroleum use.

The feasibility of a petroleum product reserve is a separate but parallel effort, as Chairman Keese mentioned. And I believe there's a workshop scheduled for mid-March on that very topic in this very room.

So for today's agenda, hopefully by now you've picked this up. It's in the back of the room, along with copies of all the presentations. We're going to be first asking Mike Jackson from Arthur D. Little to review the program plan that was presented at the last workshop, and update you on the schedule.

Second, we will have a presentation, a very detailed presentation on the quantification of environmental benefits of reducing petroleum use.

Third, we'll have a presentation by Peter Berck of UC Berkeley's Economics Department on a model that he has developed and will be using to assist us in gauging the impact on the state's economy, on jobs, income, et cetera, of various strategies and scenarios reducing petroleum use.

And then this afternoon we're going to focus to the issue of national fuel economy standards, and how vehicles can be improved over time using both off-the-shelf technology and advanced vehicle technologies.

Then lastly, our staff will be making an overview presentation of some of our preliminary results from the evaluation of specific petroleum displacement strategies.

I'm going to allow questions at the end of each speaker, so we will invite you to come to the podium, identify yourself for the record, and pose questions of individual speakers.

But at the end of the day, starting around 4:00, we will have a panel of staff present to respond to questions on the overall project, to give you an opportunity to really put the pieces together.

So, with that, I'm very pleased to see so many of you here. We encourage your active participation in these proceedings. And I'd like to introduce Mike Jackson. Thank you.

MR. JACKSON: Can everybody see the screen, in the back? Lights lower? Is that better?

All right, I want to spend just a little bit of time -- my name's Mike Jackson; I'm with Arthur D. Little Acurex Environmental -- and I want to spend a little bit of time this morning just going over the program plan overview for this particular project. And put sort of in perspective what our goals are for today in this workshop. And, in particular, to try to get input from you that are here in the audience. That's one of the most major things we want to do today.

So, what I want to do in this outline here, in this presentation, is to walk through a little bit what the demand for gasoline and diesel is. We talked about this last time at the last workshop where we went through in some detail what the basecase is for California in the timeframe we're talking about for this particular project.

And then I want to talk a little bit about the roles that the various agencies are playing, both the California Energy Commission and the Air Resources Board. Talk about how we've structured the work. And then talk a little bit about two of the tasks. And we're going to spend more time today on the ARB's estimate of environmental and economic impacts than we did last time on CEC's assessment of strategies and costs.

We're going to talk a little bit about the displacement strategies that CEC has completed since the last workshop.

And then I want to finally end talking a little bit about some of the milestones and what dates we're trying to achieve here.

All right, sort of as the baseline projection here, what I've show is this in terms of a timeframe versus fuel demand in terms of billion gallons of gasoline equivalent. So this includes both the onroad light duty gasoline demand, as well as the heavy duty diesel onroad demand. And it's just expressed in this particular chart in terms of gallons of gasoline.

And you can see we're at about 17 billion gallons per year, 2000. And this going to 2030 will grow to about 30 billion gallons.

And what you can see, where we are, relative to refinery capacity, it's pretty level right now. It's not expected to grow, at least in California. There might be slight increases here, but it's pretty much capped at about what today's demand is for gasoline and diesel fuels.

So the question is how do we make up for the shortfall that occurs in this particular triangle here. And you have various strategies that can do that.

You can reduce the demand, have higher efficiency vehicles. You can bring in imported products, either from other states or from foreign sources. Or you could use some other kind of displacement strategy like an alternative fuel.

So that's sort of the scope and that's sort of what we set out to try to figure out, is what are the costs and benefits of these various strategies. And how does that compare to the baseline case.

As Susan mentioned, the enabling legislation here is AB-2076 authored by Shelley. It's a joint CEC, California Energy Commission, and ARB effort to look at this whole issue of petroleum dependency and how it's going to affect the citizens of California.

We divided it into sort of two strengths of the agencies. The CEC efforts focused on primarily identifying the strategies, analyzing the strategies and performing detailed cost analysis. Whereas the ARB's efforts are focusing more on the environmental and, to a certain extent, the economic cost/benefit analysis.

We're combining those two efforts in the end to come up with recommended goals that we can present to the Legislature. Evaluating various policy options based on the results that come out. And then issuing recommendations to both the Governor and the Legislature on how to deal with the issue that's in front of us.

We divided the work into basically six tasks which are shown here. On the top we have task one, which is estimating the benefits of reducing demand for gasoline and diesel. Again, this is primarily the ARB focus, which we at Arthur D. Little Acurex are helping out on.

Task two is the problem definition. We're really looking at what is the issues associated with gasoline and diesel, especially the onroad supply and demand in the future years. And that was pretty much done at the last workshop where we went through the whole baseline projection of where we are in terms of today's demand, and where we're going to be in 2030, and where we're going to be in 2050.

What is the long-term price of these products from today, in the out-years. What do we think oil's going to be priced at. All that was reviewed last time. If you don't have it, it's on the web. There's a baseline projection that CEC put out on this. You'll see some of those numbers presented again today, but nothing in detail like we did last time.

Task three has to do with looking at the various strategies that might be able to reduce or displace gasoline and diesel in the onroad sector. And, again, we spent a lot of time in the last workshop dealing with that. We're going to spend some time this workshop, but not nearly as much as we did last time.

And the idea there is to take those three tasks, integrate them into looking at proposed reduction in goals and policies. And an important part is you guys in the audience. We really need to have your comment on what we're doing here, and whether we're on the right path. Whether we got sort of the right numbers from your perspective. We want feedback.

So, we'd encourage you, throughout this particular workshop this morning, and it is a workshop, to get up and share your ideas with us.

Then finally that gets all integrated and comes out with a report that would provide recommendations to the Governor and Legislature.

And we're going to try to deal with this in terms of reporting, to give not only an executive summary, but for each major block of work, for example, volume one will talk about the benefits of petroleum reduction from an environmental perspective; volume two will detail the analysis of the strategies; volume three will talk about how we went about trying to integrate the benefits and the strategies and their costs into coming up with some sort of policies.

And each one of those you'll have a chance to input.

This shows task one sort of outline. I'm going to talk about this in more detail later, so I'm going to kind of go through this real quickly, but we're trying to look at both all the air impacts, not only criteria, NOx, CO, hydrocarbons, but toxics, PMs, benzine, 1-3 butadiene, things of that nature, as well as global warming. And this is just a way of categorizing it.

We're also trying to look at multimedia impacts, spills, other impacts that would happen. And then economic impacts that would occur, lower, say, petroleum consumption, and there's going to be a whole presentation on that today by Peter Berck of U.C. Berkeley. So I'm not going to spend a lot of time on that. You'll see what that methodology looks like.

And then there's going to be other aspects that we need to consider. For example, if you reduce the cost of driving, maybe VMT goes up. So you got to take into account some of those kind of subtleties.

This is the task three effort which

really looks at all the strategies. You can see a lot, a list of strategies here. The whole idea here was to come out with an analysis methodology where you could estimate cost and benefit of reducing the petroleum.

And the idea was to come up with ranges here of what we expect the major drivers of the various strategies are. Is it gas; is it the cost of the infrastructure; is it the cost of the incremental cost of a alternative fuel vehicle. What drives the cost of these strategies.

Okay, milestones. This is slightly changed from the last time that we presented these milestones. We did have the petroleum reduction strategies workshops which was asking for ideas from the public. That happened on September 17th and 18th here in this room.

Then we went through in workshops sort of the basecase demand forecast, and preliminary analysis of the petroleum reduction strategies. That happened on the 16th.

Today we want to sort of outline what the methodology is going to be for estimating the environmental impacts, and to get some feedback from you, the public, today.

We are going to strive to get CEC's strategy draft report available around the 19th of March. We're working really hard at trying to put all these details together and make that happen.

There will be another workshop at the end of March, scheduled now for March 28th, where you'll be able to see how it's been integrated, how the results have been integrated. And probably a pretty good idea of what policies people are considering at this point.

That then will go through a series in April, a series of meetings. We'll first issue the draft final report for public review on April 5th. It will then go through the CEC Fuels Committee hearing on the 15th; ARB hearing will occur around April 25th. And then finally back to a CEC business meeting on the 1st. And then it will be issued to the Legislature and the Governor. So that's a very aggressive time schedule that we have.

And we want to hear all your input today, as the day goes along, so don't be bashful about getting up and making comments.

Okay, that sort of ends the program plan overview. I'd be happy to take any questions you have on that.

Okay, let's move on to the second part that we're going to do here. What I want to try to do in this presentation is give you an overview of how we're going about estimating the environmental benefits for various strategies. So, the idea here is if we could reduce the amount of oil that's being refined in California, does that have some benefit environmentally.

And there's various strategies that we can look at to do that. Let me just acknowledge several people here. Nalu Kaahaaina, who is one of my staff, who's here in the audience, who's done a lot of work to help me on this. And Robb Barnett, also, of our staff down in Los Angeles, who's done a lot of work to help us on this.

What I want to do from an agenda point of view is kind of give you an overview of the problem, and I'm going to walk through primarily the chart that talks about the task one effort.

Then I want to talk specifically in detail about the methodology for estimating some of the benefits from air emissions, greenhouse gases, petroleum spills, and then I want to summarize what that gets you in the end in terms of a dollar per gallon of gasoline displaced.

And I'm going to kind of walk through each one of those elements. You're going to get a picture of what's important, what's not important. Again, I think the methodology is reasonably sound. I think one could argue about some of the questions, some of the assumptions that go into it. And that's where we're going to need a lot of your feedback.

The elements of today's presentation that I want to focus on are on the air impacts, they're checked here; the criteria pollutants and toxics; global warming; and then some estimate of what happens to a product as it is spilled and leaked. That's just one of the multimedia impacts.

As I said, the following presentation to this, Peter Berck will be talking about the economic impacts. So you'll hear what that methodology is all about. There's not going to be a lot of numbers on it, but you'll get an idea of what the methodology is and what we're trying to achieve.

So, let's move on to air emissions. What we're looking at here is trying to understand what the criteria emissions, NOx, CO, hydrocarbons and particulate matter. These are the ones that are regulated. These are the ones that have to meet national and state air quality standards, the ambient air quality standards.

But we also want to look at what impacts would happen relative to toxics emissions. Well, what do we mean by toxics. We're talking about benzene, 1-2 butadiene, xylenes, formaldehydes, and there's others.

Also, PM is now listed as a toxic air contaminant, too, so we include that in there. There's a statewide PM program. It's an important thing to keep track of.

And what we're looking at is looking at the total fuel cycle, so to speak, so you would go from extraction; there would be distribution; transportation, then distribution. That's all what we are determining here, upstream emissions.

Everything after it gets into the tank of the vehicle, and anything that happens after the tank is what we call downstream emissions, for the terminology here.

I'm going to make some relatively major assumptions here, and you're going to get a feel for how well these assumptions are as we go through this analysis. But you can think of where the emissions might come from.

For example, the current refining industry has emissions that are already in place. If we don't increase the capacity of the refining capacity in California we're probably not going to affect the emissions of those refineries.

So, from our marginal analysis, if we don't increase the refining capacity there is no impact of displacing any of the fuel.

Now, there are emissions if we don't increase the refining capacity, then we're going to probably import refined product. There are emissions associated with importing that refined product. And those emissions would come from coastal refined product shipping, storage, distribution. You still have to dispense it; you still have to have trucks that drive the product from storage or the refinery where it would probably come to, and there'd be some more, some work done on it, but not nearly as much work done as if you had to take crude oil from the start point.

And then there would be vehicle

emissions. And what we're saying basically for first order analysis is that really on the refinery side we're not going to count any of those emissions. We're going to assume that the refinery is pretty much going to emit what it emits today, but demand for refined product will increase, but there will be no net increases in emissions.

On the importing the refined products we're going to try to account for the upstream emission benefits that occur due to distributing that fuel.

And then on the vehicle side, and this is an important assumption here, too. We're going to assume that by 2010 we basically meet ambient air quality standards here in California.

Furthermore, we're going to assume that once you do that, that there is really no benefit. You'll see that this assumption really doesn't matter anyway, but there is no benefit of reducing then NOx, CO or hydrocarbons based on EV vehicle technologies. So, an EV, for example, which has zero, quote-unquote, zero emissions really doesn't give you any value on the vehicle side in the out years. Because we're going to be in attainment.

That's the assumption.

So, really, the game comes down to determining the upstream emission benefits, and we're going to do that based on a gallon of diesel emission factors, a gallon of diesel or a gallon of gasoline used.

Then we can see as we displace the amount of petroleum that is used, we reduce the demand or we displace it, and there is some net emission benefit.

And then you can monetize that emission benefit, and then determine what the dollar value of that indirect benefit would be. So that's the methodology.

I'm going to kind of walk through for each one of the major things, air, greenhouse and some of the multimedia, the spills, so you can get an idea of the order of magnitude of the dollar per gallon, the dollar benefit, indirect benefit per gallon of fuel displaced.

So, all right, on air emissions, now this is again on the criteria. The emission factors are based on energy inputs to the fuel chain, including extraction, transportation and refining. So basically we're looking at a fuel cycle analysis and trying to track at each point in that analysis whether we move product by shipping, we move product by pipelines, we move product by trucks. Gets to the terminal and then it goes by trucks from the terminal to the service stations. What are the emission impacts of each one of those events. And we've tried to track that throughout the cycle.

The marginal emissions consist of tanker ship and local truck transportation, as well as bulk storage and local fueling station emissions. All right, there's no refinery emissions in here. Again, the assumption if that we're not increasing the refining capacity in California. It happens in Washington, it happens in China, it happens somewhere else.

Emission factors are based on known factors for ships, trucks, fuel, transfer equipment, spillage and subsequent evaporation contributions of the hydrocarbons are based on our engineering judgment.

And these numbers have been shown in a number of places. We've done -- this analysis was done as part of the EV work, and EV hearing that was done by ARB about a year ago or so.

All right. So, what's the results? We've broken this up in terms of gasoline and diesel. And again, I'm talking only NOx, hydrocarbons, NMOG and CO. You can see the emission factors. For NOx they're about .073 or .78 in the case of diesel. Not much different in terms of grams of NOx per gallon, diesel or gasoline.

And then we've just taken an example here and used a billion gallons of gasoline that's avoided, just to give you an idea of what the tons per year would be from the upstream events if you did that.

So, for example, on gasoline NOx, at that emission factor if you avoided or you were able to reduce somehow the demand by a billion gallons, you would save, or you would basically get rid of 80 tons per year of NOx.

If you use values that have been used in the trading documents of ARB in terms of values, NOx on a dollar per ton basis, or NMOG on a dollar per ton basis, or CO, which are shown here, that was based on ARB's emission reduction offset transaction cost summary report for 2000. If you use those numbers you can get an idea of what the savings is per year in dollars.

And if you divide that by the amount that you displaced it gives you an idea of what the benefit would be on the displaced gallons.

So, on a dollar per gallon, a dollar per displaced gallon basis, you can see that the air toxics, the criteria pollutants here, not including PM, just these that are shown here, are on the order of 5 to 4 mills. So about .5 cents to about .4 cents per gallon displaced.

All right, what about toxics. That's a little harder, but we've used ARB's established methodology, which is really EPA's methodology, too. It's been modified slightly, but it's the USEPA's criteria air pollutant modeling system.

This particular model is a population based systems for modeling exposures to criteria pollutants in estimating health benefits. Recognized methodology. It's been used in the Clean Air Act. It's been used in California to figure out what the cost/benefits may be. It's a concentration response functions, it uses concentration response functions to estimate the relationship between air pollution exposure and adverse health effects.

CR functions are derived from epidemiological studies. Divides California into smaller grids. And estimates the change that occurs in the incident of health effect with changes in air quality.

Then it's summed up to give you a statewide answer, and it uses existing literature values for calculating the health end points to monetize this value.

Now, let me just give you an example how that works. This is real -- here is -- this is going to be hard to see in the back. Hopefully you have a copy of this.

But this is just an output. What we gave ARB here was what if you had the situation where you could reduce, it's hypothetical, you could reduce PM emission from vehicles by 15.6 tons per day.

And what would happen to -- how would that improve health in the year 2010. The reason the year is so important it's population based. So if you go up in years, the population increases, then you're going to expose more people. Okay.

The net result, when you figure

everything out in terms of mortality, chronic illness, hospitalization, minor illnesses, you can see comes up to about $1.3 billion value. Most of that comes from one place. Mortality.

These are much much smaller in terms of the monetation, even though they're important. So that's why PM, at least from a PM risk, is such an important part of California's plan to reduce PM right now. It's a big number.

Now, what I did, just to get us through today's presentation -- we have a lot more work, we have a lot more of these models to run, but I needed to come up with an emissions factor for PM. And this is a little bit flaky, but I just took those results in terms of emissions and estimated what the dollar per ton value would be, based on the number that we got in the previous analysis, in terms of tons per day of reduction.

And you can see that these emission factors again come from our methodology of figuring out what all the upstream emission factors are. So, again, we followed the fuel cycle chain, we followed the events in terms of distributing the fuel.

So that's PM that's coming from trucks,

PM coming from whatever you need to do to move the fuel around, or toxics, the same thing. Most of the toxics on the gasoline you'll see are slightly on order of magnitude almost an order or magnitude higher. And it comes mostly from the evaporation effects.

Again, using these relatively what I would call gross assumptions to calculate these numbers you can still see that the effect of PM is pretty small in terms of a dollar per gallon displaced again. We're still in the mills range and not the cents range.

Now, we still have to do a lot of work here. This is only upstream emissions. There are strategies where the downstream emissions will be just as important. So, for example, a fuel cell vehicle potentially is not going to have engine related PM emissions. That's not shown on this chart. But it gives you an idea of the upstream emissions. And, you know, based on this analysis, it says it's not all that important.

If you take and combine now these two strategies, or the two areas, both criteria and toxics, you can see that we're almost at a cent per gallon displaced range. .78 for gasoline; .59

for diesel.

Again, I have to emphasize that this is all the upstream events. It doesn't account for any of the downstream events, any of the things that happen on the vehicle.

The assumption again is that in the out years there's no value for being lower than perhaps what the standard might be. We are going to be in attainment, we don't have to monetize that value at all.

All right, let me turn to greenhouse gases. Methodology here was to look at the transportation sector and then count all the greenhouse gases that are important, CO_2, methane, nitrous oxide. We're not going to be considering ourselves with the refrigerants. Only looking at the first three of those.

And we're going to do the same thing as we did in terms of the prior analysis for the criteria and toxic emissions. We're going to look at all the events, extraction, refining, transportation and distribution. Here we're going to count refining.

It's not a marginal analysis. We're also going to look at the downstream events, what happens at the tailpipe. How much CO2 comes out of the vehicle. And how does that compare to the upstream events. Are the upstream events bigger or smaller than the downstream events.

And then what happens, we're going to try to evaluate what happens when you decrease the use of petroleum fuels here. How does that affect greenhouse gas emissions.

What are the results in the upstream and downstream greenhouse gas benefits. And you have various things that you can do here. You have energy efficiency again, which are upstream and downstream events. You have alternative fuels which could displace the petroleum based fuels. You have upstream events there, but you could also have downstream events; in some cases some of these alternative fuels may be worse than some of the petroleum fuels. But you have to account for all those.

Just to give you an idea of what we're talking about in terms of emissions you could have a refinery that's based somewhere else besides the United States. You could extractions somewhere else in the world; you could refine it somewhere else in the world. Then you have to ship it to

California. Then goes into probably the refineries, maybe it's not totally refined to RFG. Maybe there has to be some work done on it some more.

Then it would be, you know, transported through pipelines and to the terminals; and then from the terminals to trucking; trucking to the stations, et cetera, et cetera.

We're trying to follow all the CO emission benefits, basically doing a carbon balances on all the steps.

Once you get to California then you basically go from the terminals to trucking it, the underground tank, to dispensing. And then into the vehicle and then it runs around. Again, trying to follow all the steps of where that carbon goes.

And this chart kind of summarizes that. We need to know what the fuel properties are, of course, for the various fuels, be it California RFG, be it carb diesel, be it ultra low, whatever it is. We need to know that.

We need to determine the inputs for the refining based on the refinery models that we have. We'll allocate the refinery energy to the product streams, be it gasoline, be it diesel, be it jet A, whatever it is.

Estimate the energy for the crude oil extraction and transport. Calculate the CO_2 emissions from the energy -- from energy from energy, okay, for extraction, transport and refining. We're also tracking the methane throughout the whole cycle and the nitrous oxides emissions. And then converting those to equivalent CO_2s using established conversion factors.

All this that we have done in terms of our modeling agrees very well with Argonne National Lab's GREET model which is sort of the accepted methodology these days.

And then you get it into the vehicle and you make sure you calculate the CO_2 content based on the fuel, and then subtracting off the small amount of CO_2 emissions that occur.

This next chart just shows you the accepted factors that have been used in various modeling schemes. You can see, for example, methane's about 21 times more -- has more global warming potential than CO_2. N_2O is about 300 times more. And, of course, the hydrofluorocarbons are much much more in some cases.

All right. The hard part, this is where we need some input from you people, is how you monetize the value of CO_2. We've picked a number here, $25 a ton. Is that a good number? It's a number that's been bandied about. There's really no good references on this that we've found. Any input on this would be helpful.

It's equal to about -- that's equal to about $92 a ton carbon emissions as opposed to CO_2 emissions. You could argue that that number, you could come to that number by thinking about what the costs of cleanup are; how much it would cost to sequester CO_2. Or what would be the cost to mitigate some of the impacts of global warming here in California.

Well, that's a lot of analysis. And whether we'd come up with $25 a ton is still unclear to me. But, this is a number that we've got right now, and we're looking for your input and others' on how to best come up with a good number to value the CO_2 emissions.

And we conclude that further research is needed on this topic. If I use that number, however, here's the impact. Let me talk a little bit first about the emission factors.

Again, talked about gasoline. We have upstream, downstream events. Diesel, upstream, downstream events. You can see that the emission factors here, in terms of grams per gallon of gasoline or grams per gallon of diesel. The downstream, i.e., the vehicle combustion dominates the scene, either on the gasoline side or the diesel side.

At $25 a ton, these become pretty big numbers. These are not mills anymore. These are tens of cents. For example, gasoline, we're talking about 31 cents. Diesel, we're talking about 35 cent benefit. So that's why we're concerned and we need to have more input on the dollar per ton value of value in terms of monetizing CO2 benefits.

Just some observations here. The downstream, not surprisingly, the downstream events, tailpipe emissions contribute to the majority of the greenhouse gas emissions. The significance of methane and nitrous oxide, although small, needs to be considered throughout the analysis.

I've said this already, but the monetized value of equivalent CO2 emissions needs further input and discussion with all interested stakeholders.

And just as a final comment here, we all understand that global greenhouse gas warming effects are global in nature, determine the impacts or benefits to California is not necessarily all that straightforward.

All right, let me now turn to looking at some of the multimedia impacts. And I'm only going to look at petroleum spills today. Our methodology here again was similar to the methodology that we used in the previous two areas, and that is to track the distribution, track the spills for the distribution system.

What's the distribution system. Well, you import crude and refined products. They're usually arriving by marine tanker into California. Petroleum is off-loaded to storage tanks or to feeder pipelines. Petroleum is transported by tanker truck or feeder pipeline to refineries. Crude and refined products are stored in tanks at the refinery.

Refined products are transported from

the refinery by tanker trucks, jobbers, petroleum company employees and contractors, or terminal pipelines. And then the products are stored and distributed at commercial and private dispensing facilities.

Okay, spilled petroleum affects many aspects of the environment, and they occur at various points in the handling of petroleum. You have it in marine waters, you have coastline, you have soil, you have surface water bodies, you have underground supplies, et cetera.

And obviously you can have different forms of petroleum are going to have different effects in terms of damage. Then you got to try to account for that when you put this together. And you have, in general, our understanding of this is that industry is responsible for cleaning up their spills at this point, but there are other societal costs that aren't necessarily recovered in any kind of spill that occurs.

You might have damages to wildlife that eventually recover, but how do you account for those wildlife that did die in the event.

I'm just going to run through these real quickly just to give you an idea of what we're talking about. You have marine spills, open ocean spills, they can be coastline spills, whatever. This is sort of indicative of that.

You have spills that can occur on land either due to pipeline leakage; they happen at the refinery; they can happen during transportation; they could happen in underground storage tanks.

Pipeline leaks do happen. It's getting less and less, but they still do happen. Leaking underground storage tanks, I think everybody's familiar with some of the issues with the leaking underground storage tanks, especially with the MTBE. So I'm not going to spend a lot of time on that.

The bottomline is shown in this chart. What I'm showing here is the estimated annual spill volume; that's these bars. Versus the estimated annual cleanup costs, which are these dots in the blue line.

So, for example, marine. It's estimated in California that 63,000 gallons of crude are spilled in the marine waters every year. With today's volume of refining, which is roughly at about, for California, is roughly at about 628 million barrels per year. So it's pretty small compared to this group what we're talking about.

Pipeline, a little bigger. Refineries, much bigger, but I -- and transport, sort of, you know, on the same order as refineries. The underground storage tanks, we can't find a very good number for the leakage there, but we could find a pretty good number for the cleanup costs.

And you can see that the cleanup costs are, for pipeline and refineries, are fairly low. A little bit higher when you spill it in the open ocean. And I'm assuming that these are lower just because the refineries have ways of handling their spills a lot easier, they're more confined compared to what you would see on the open ocean.

All right, so what's the bottomline here. Roughly, in California, about 5 million gallons of either crude or petroleum product is spilled. If you go through the numbers and try to allocate it to gasoline and diesel fuels, onroad gasoline and diesel fuels, you come up with about 2 cent number.

I think most of these costs are covered by industry. So, I'm not real clear as to whether I should count this as a benefit or not. In other words, it's probably in the cost of the gasoline that's being distributed. So, I'd appreciate industry comment on that.

Let me just kind of try to put this all in perspective then, relative to a summary. What are we talking about. Using sort of the same figures we've used before of gasoline with the various species, I have the emission factors, I have the assumed dollars per ton, and I have the ton per year for a case of displacing one billion gallons of gasoline. I have the dollars per year and I have the dollar per displaced gallon shown here.

And I've thrown petroleum spills in here; it may or may not be correct. It's a small number compared to the other numbers, of the total number. You come up with a bottomline for gasoline of about a net indirect benefit of about 34 cents per displaced gallon. And for diesel about 38 cents per displaced gallon. I don't put much significance between the difference between these two. Call it 35 cents, if you wish.

But that's what we're seeing for what we think for these categories, net benefits are.

Okay, what we sort of conclude here is that the upstream air emission benefits, NOx, CO, hydrocarbons. They're really negligible relative to a benefit, a monetized benefit.

PM and toxic emission benefits are about ten times greater than the air emissions, but still very small, on the order of mills, not cents, not tens of cents.

And the greenhouse gas emissions, by far, dominate. They're 1000 times greater than PM and toxics emissions, for example, and they get you into the 30, 35 cents range. But it's based on an assumption of $25 per ton of CO2. And that's a number that we're going to have to focus on more closely and are seeking industry input.

The spilled costs are again fairly small, on the order of cents. Important, yes, but probably included already in the price of gasoline that we buy. So I conclude that we really need a good balance assessment of the CO2 evaluation for California.

That concludes this part of the presentation. And I'd be happy to take comments and questions. Please step to the microphone.

DR. TRINDADE: Good morning, Mike.

MR. JACKSON: 'Morning.

DR. TRINDADE: Enjoyed the presentation.

Good morning, everybody.

Three things. I'm Sergio Trindade, SE2T International. Three points, as I indicated. First one is the assumption is that there is gasoline coming outside California to meet increasing demand at some point. And we do know that the capacity to make gasoline to meet California specifications is very limited outside California.

So the implicit assumption is that there will be a certain demand in California to justify foreign refineries to develop processes to produce California specification gasoline. So this is one point.

The second thing is obviously it took the whole presentation to show the obvious, that greenhouse is the leading culprit. And considering the fact that at the federal level greenhouse is almost nonexistent in terms of national policy, although there have been some recent attempts at the federal level, how can the State of California play a role in bringing the greenhouse issue into such a broader national context that other state level can benefit.

And the issue you have with setting up

the prices is a tough one. And then I would just make the comment that the value of carbon will not be defined by costs. It will be defined by the marketplace because at some point in time with or without the United States' participation, a market is evolving. And we have already today transactions taking place internationally involving carbon.

So I think it's going to be more on the side of the marketplace to decide what is the value. And it will cover a range. $25 a ton is not too bad, but there are better prices in that range.

And finally -- sorry to take so much time -- as you know I am an energywise alcoholic. And I notice that there hasn't been a reference to alcohol in the context of the discussions. And it has -- it's small, I mean, I recognize that, but it has definitely a benefit on the greenhouse front. And as well on the emissions front.

Thank you very much.

MR. JACKSON: We recognize, Sergio, the fact that refineries outside of California may not be capable today of producing RFG, California specified fuels. It may be that a lot of what gets imported into California, at least in the early years, will be blend stocks that will be further refined here in California until, you know, a large enough market say develops to justify the investment for world refineries to have the capability of producing California specified fuels.

I'd like to hear from the refining industry a little bit on that.

On greenhouse gas emissions, that's sort of our -- the federal level has not paid much attention to this, the Bush Administration. Part of the issue here before us in this whole process is how do we come up with policies that may have some help here. And whether that's even important for California.

And I appreciate your comments on the value of CO2 in terms of the marketplace. And we are looking at various alcohols as a displacement strategy. You didn't see that here today, but that will be evaluated.

Thank you for your comments.

DR. McCANN: I'm Richard McCann with M.Cubed, representing Diesel Technology Forum. And I have a couple of questions and some comments.

First, have you done the same analysis for other fuels, for example, natural gas, ethanol, et cetera?

MR. JACKSON: We have, I just haven't shown them here --

MR. McCANN: Okay, because one of the things I wanted to note was that natural gas, of late, has got some attention for toxicity levels. In the South Coast they're now hindering the siting of distributed generation microturbines because natural gas has been found to be more toxic than what was originally anticipated.

MR. JACKSON: Like every other technology there are cleanup devices that potentially can be used to deal with some of these issues.

DR. McCANN: Right, right. And then I wanted to direct your attention to a set of comments, or two-page comments that are out on the front about using a holistic approach to assessing health impacts.

One of the categories I did not see up there was vehicle safety. And, in particular, this relates to fuel economy issues. And also fuel carrying safety, relative fuel carrying safety of various fuels.

In particular, looking at the CAFE standards there was a study that just came out from the National Research Council, which I'm not sure if you've gotten, because it is really brand new, that found that there were about -- that CAFE standards have added about 2000 deaths per year and about 150,000 injury accident related injuries per year.

And in going through that analysis, if you use the various parameters that are in the model and you come up with about a 15 percent increase in fuel economy for automobiles, and about 30 percent for light duty trucks, you end up finding that that kind of increase will add about 500 deaths per year to the -- in the accident rate. And that actually converts to about $2 billion a year in terms of impacts and costs.

And it seems that you would need, in this approach and doing this analysis, you need to incorporate vehicle safety factors in this analysis, as well.

MR. JACKSON: Although you saw the impact of PM, which was a $1.3 billion, --

DR. McCANN: Right, --

MR. JACKSON: -- which was very very small in terms of impact per gallon displaced, so if it's a 2 billion number it's not going to be very big, Richard.

DR. McCANN: Right, well, there is the accident -- the impact associated with accidents. But I understand. I mean one of the issues you've talked about, the fact that the greenhouse gas value is actually quite wide.

I mean there's market transactions for carbon going $5 a ton right now. So, you know, there is a very big range of parameters.

So, in fact, one of the things is we still need to focus on some of those smaller values, as well. And highlight those issues. Because one of the things is that there is associated with global climate changes there is a lot of uncertainty about what the ultimate impacts will be, et cetera. There's a lot less uncertainty about the impacts of increased automobile accident deaths.

So, I just wanted to make that point. Thank you.

MR. HWANG: Roland Hwang with the

Natural Resources Defense Council. I have three comments to make on the presentation, Mike, but just to follow up on the last comment on safety and fuel economy.

Obviously there is a lot of controversy, even within the NRC report about the impact of past fuel economy standards on safety. And there is a very good dissenting opinion by Dr. David Green in the back of the NRC report, which we concur with, in that the data does not support that conclusion. That's a conclusion that cannot be supported by a rigorous analysis.

And furthermore, that increasing fuel economy standards could obviously be done, clearly be done without affecting size or mass of the fleet, or power, indeed, of the fleet. And therefore there is clearly a technological pathway for which fuel economies can be increased without affecting safety.

So we think that's obviously a very critical issue, but it's somewhat of a red herring, but it should be addressed. We agree it should be addressed in the report and discussed.

The second issue is in terms of evaluation of the hydrocarbon and nitrogen oxide upstream benefits. Clearly monetization is one way of valuing it, but another, we would encourage that this report also look at the very important need for California to gain additional tons of reductions in order to meet its upcoming SIP, state implementation plan, attainment needs.

Clearly California in 2010, the South Coast, San Joaquin Valley short on tons. The Air Resources Board, I think, estimates late last year under the Clean Air Plan, they were estimating something like 100 tons per day of smog forming pollutant in the South Coast, will be short something like 180 tons, I believe, each of NOx and hydrocarbons in the San Joaquin Valley.

So, while the monetization of the values may not look big, in comparison to some of the other benefits of reducing petroleum, clearly there's a big benefit, especially if it can be done in a very cost effective manner of reducing even one ton, ten tons, you know, even in that range. A big benefit and a big need, I think, as you're aware, Mike, of the big need for finding additional tons.

So we would encourage this report also look at that kind of benefit of assisting us with our air quality needs.

The third comment has to do with California's role and responsibility in planning for a future where we can mitigate and avoid some of the disastrous effects that we're expecting to see in the state and this nation of global warming.

And we believe it's very appropriate for the state to look at the benefits and full valuation in a world where the nations of this world do take very seriously the need to reduce global warming gases.

California clearly has been very successful in reducing air pollution. Clearly has for motor vehicles, clearly has demonstrated a very effective leadership role in this area. And we believe it's very appropriate for California to continue with that leadership role. And it's very necessary for California to, within the context of this study, fully value the benefits of California taking such a leadership role in reducing climate change gases, because it's clearly not occurring at the national level at this time.

Thank you.

DR. McCANN: Richard McCann again. The

comment about the Green and Keller critique of the CAFE standards safety study is what brought me back up here.

And what I found, I reviewed that quite closely and found that it actually had three fundamental flaws that rendered its findings, its conclusions basically useless in a critique of the CAFE safety standards.

The first problem is that they confused cause and outcome of accidents. That is drivers do cause the accidents, but the outcome of the accidents are affected by vehicle characteristics.

The second thing is that they concluded that crash tests were a better indicator of likely single accident fatality rates rather than actual real world data. To me that raises the question -- the better question that they failed to ask was why don't crash tests actually match real world data.

And the third problem was actually the one that is most critical is that they hadn't omitted variable bias in the regression that they did. The forgot to include safety regulations and improvement in safety regulations over time in their regression equation.

And, of course, then what happened is that they picked up a positive benefit from fuel economy with that omitted variable bias.

So essentially, Green and Keller's critique, while there may be problems with the analysis, Green and Keller didn't identify any of those problems. They just completely missed the mark.

And the NRC Committee, the rest of the committee identified that and 13 of the 15 studies that they cited found that the CAFE standards did reduce safety in motor vehicles over time. And that's the general consensus of the literature.

Thank you.

MS. HOLMES-GEN: Hello, I'm Bonnie Holmes-Gen with the American Lung Association. I guess I was very surprised at the assumption of attainment in 2010; and the assumption that there would be no benefit from any reduction in tailpipe emissions after 2010.

First of all, it seems very unclear that the attainment deadlines will be met, and I know the previous speaker talked a little bit about this, but it seems far from certain at this time. We certainly hope that happens, but there are a lot of obstacles in the way.

Even if that assumption was correct, and the attainment deadline was met, we will need to continue our regressive efforts to reduce tailpipe emissions in order to stay in attainment. And there certainly is a monetary benefit to maintaining the attainment status, maintaining the emissions reductions that we need to insure that we do meet our health-based standards.

So, there's aggressive efforts needed after 2010, and there are benefits, certainly health benefits, economic benefits to continuing to reduce tailpipe emissions.

In addition, I wanted to understand, I didn't think that you included the downstream emissions for air toxics in your analysis, is that correct?

MR. JACKSON: That's correct, for the particular assumptions you are looking at here, which had really to do with -- you'll see it this afternoon, but it's really an energy efficiency analysis that we've done here.

When you start looking at some of the other strategies like, you know, maybe a displacement using something like a fuel cell technology, then some of the downstream toxics are going to be very important.

How important? Probably not as important as we think, but important. They'll be on the order of cents, not twenties of cents.

MS. HOLMES-GEN: So you are going to include downstream toxics emissions --

MR. JACKSON: Right. The methodology is --

MS. HOLMES-GEN: -- in the analysis?

MR. JACKSON: -- meant to work for each one of the strategies. The particular assumptions that I showed today have more to do with energy efficiency strategies as opposed to fuel displacement strategies.

But for each one of the strategies the CEC has looked at, we want to evaluate what the overall indirect benefits are. So you have to go through for each strategy.

On an energy efficiency strategy it's displacing gasoline. So it's mostly the upstream events that count. For something like, let's say, let's pick a fuel cell strategy, the upstream count because you're using a different fuel, say hydrogen for example.

The downstream count, too, now. Maybe not so much in the criteria pollutants, because I can carry those along, but they're going to be small. But in toxics they won't be so small. So there's going to be -- but, again, they're probably on the order of one, two, three cents, not tens or twenties of cents.

MS. HOLMES-GEN: Does that include the estimates for reduction of toxics from displacement of diesel fuel? Because that would seem to be a whole other analysis.

MR. JACKSON: Again, it's hard to think of this, but remember where we're going to be in 2020, not today. In 2007 you're implementing, you know, standards that are going to take 90 percent of the particulate out of the exhaust.

MS. HOLMES-GEN: Yes, --

MR. JACKSON: So it's hard to think about near term versus --

MS. HOLMES-GEN: Well, I understand that, but --

MR. JACKSON: -- more far term.

MS. HOLMES-GEN: -- we traditionally struggle with these measures. They aren't quite as easy and quite as sewn up as we like to think.

And it probably will take us a little longer to get the full benefit.

MR. JACKSON: Right. Appreciate your comments.

MR. KOEHLER: Neil Koehler with Kinergy Resources. Two comments just generally in response to some of the conversation about fuel economy standards.

It's, to me, just obviously clear that the most significant thing we can do to reduce petroleum dependence and improve our situation vis-a-vis climate change is an aggressive move towards higher fuel economy standards. And I'm confident this report will include that kind of recommendation.

Second most important thing we can do is encourage the use of renewable fuels as a replacement for those petroleum fuels that we're left with.

And I just had a followup comment on what Sergio had brought up in terms of the use of ethanol. Appreciate your comments that you'll be looking at that on the displacement side. And I just wanted to insure that in the analysis of gasoline that the blends of ethanol in the gasoline are also calculated in those formulations.

Based on the Argonne study, the most recent one on the CO_2 benefits of the use of ethanol, using their calculations with the 1.7, almost 1.78 billion gallons of ethanol used in the United States last year, there was a CO_2 equivalent benefit on climate change of 1.2 million tons. And using the calculations of $25 per ton, that's a $30 million benefit that the United States' economy received last year based on those calculations.

And so clearly it's a significant benefit, and I just want to make sure that there's really a question in your methodology, will you be making sure that you break out the ethanol portion of the gasoline blend as part of the CO_2 benefit.

MR. JACKSON: Seems like a great thing to do.

MR. KOEHLER: Okay. Thanks.

MR. HINDERKS: Hi, Mitja Hinderks, Litus. I was also interested in the assumptions that you made about there being -- the reduction in gallons used would make no difference on the emissions of NOx, CO, particulates.

These assumptions are based on about a billion -- production of a billion gallons per year. And am I right in saying that approximately 5 billion gallons would be driven then at the current -- on the current projects if no reductions were made. So the reductions we're talking about are approximately one-fifth of the total gallons consumed.

Surely whatever levels of emissions cars emit in 2010, if you reduce those -- if you eliminate one-fifth of that, that would make a difference. So, that's one point.

The other point is that have you factored in the fact that when a car is certified as conforming to a certain level of emissions that actual cars that are out there on the road after a year or two, or even when they're driven from the lot, don't necessarily comply with those? Have you allowed for a noncompliance factor, that the cars actually may exceed the emissions?

The other point is in 2010 because of the climate here, the average -- I would say cars, maybe they last 25 years -- I don't know what the average age of the car on the road is, but it's got to be somewhere in the region of 12 years, 13 years.

So in 2010 if the average age is say, 12 years, maybe a fifth or a quarter of those cars might be conforming to the 2007 standards, but the other remaining three-quarters are not conforming.

So presumably these cars count, too. If we can reduce by one means or another, reduce the vehicle miles traveled, then the reduction of one-fifth of the pollutants of these older cars would surely make a difference.

MR. JACKSON: Appreciate your comments. On the billion gallons, again that was more put in there so people could see the amount of emissions on a per-year basis for a billion gallons. Everything scales. And really the number the comes out is a dollar per displaced gallon.

So, if you want to displace two billion gallons, fine, just multiply by the dollar per displaced gallon number now, and that will give you the revised benefit.

And we realize that cert versus onroad emissions are different. In general, the emission factors that we're using come from more of an average in-use fleet, not the certification numbers.

And I agree with your comments in terms of rolling in new vehicles versus what the existing fleet is, and how long it takes the existing fleet to turn over.

If you look in the heavy duty sector, for example, there are lots and lots and lots of older trucks running around. And it takes a long time for those trucks to get out of the market.

And most of what we're looking at here is aimed at new vehicles, not retrofit to old vehicles. However, that being said, there's nothing to preclude us from looking at strategies such as scrappage as a way of helping to push the older vehicles out and putting the newer vehicles in.

MR. HOWELL: Steve Howell; I'm Technical Director for the National Biodiesel Board. As you go through and look at renewable fuels and ethanol use in the gasoline market, both in the E85 and the blended form, and also like to encourage you to look at biodiesel in the diesel market, both pure, as in blended form.

We haven't seen that much pure use yet, but we are seeing increasing use in blends, especially B20, as well as a growing interest in

B2. So we'd like to encourage you to take a look at that as you go through.

MR. JACKSON: Thank you, Steve.

MS. SPELLISCY: Sandra Spelliscy with the Planning and Conservation League. Another followup on the issue of whether or not we're going to meet the 2010 standards and what that does to your environmental benefits; modeling, and how you're looking at that issue.

First of all, I think there's a couple of pretty objective things out there that have us question that. We know there is a big hole in terms of SIP attainment and what's happening with the smog check program. And ARB has laid out a number of strategies that need to be undertaken in order to make the smog check work in terms of how it fits into the SIP.

And a number of those are legislative strategies. And at this point there is no, basically no hope on the horizon for the legislative changes that need to be made in that program, that those will be made anytime in the near future.

So, I think, you know, that's a pretty objective point that we can look at in terms of whether or not we're actually going to make attainment in 2010.

The other question was whether or not, we seem to be looking at the federal primary standards for 2010, whether or not you're looking at the secondary federal secondary standards and the environmental benefits of attaining that. Then also the California standards.

And then finally ARB is doing a lot of work right now at reviewing all of its health based standards to see whether or not they actually are fully protective of children's health. And so there may be a number of changes in that area.

So, again, I think the assumptions made based on attainment in 2010, there are a lot of other variables that should be looked at.

MR. JACKSON: Appreciate your comments, Sandra.

MR. LYONS: Jim Lyons, Sierra Research. I apologize for my voice in advance. First, Mike, the last time I saw a presentation regarding your methodology on upstream emissions it had yet to take in account ARB's enhanced vapor recovery regulations for service stations and distribution.

Are those regulations now accounted for?

MR. JACKSON: My understanding, yes, but I'll have to double check it.

MR. LYONS: Okay, secondly, I understand the values for criteria pollutants don't really drive your analysis. You've used emission reduction credit values is my understanding?

MR. JACKSON: Um-hum.

MR. LYONS: It's my understanding that those are in units of tons are dollars per ton, but it's actually to allow that facility to emit that many tons each year. And so it's kind of an apples to oranges comparison. You're taking that dollar value for a string of emissions and comparing it to a single event, like displacement of a billion gallons of gasoline.

I'd suggest maybe you look more at cost effectiveness ratios that ARB's adopted, which are an apples to apples basis. I recently looked at some stuff for evaporative controls with EVR and some other regulations and instead of 6500 dollars a ton for NMOG, it would be more like 2000. So while it's not going to have a major effect, it's, you know, factors of three or four.

And then with respect to the PM and the

toxics, I'm not sure where those numbers came from, but they also look awfully high. And was I correct in my seeing that you're including xylenes and other things, that ARB is not traditionally counting in their toxic air contaminant analysis, in this analysis?

MR. JACKSON: Well, I didn't get into detailed toxics analysis, but it was really really crude in this analysis. Basically I took a certain percentage of what the PM was.

The South Coast -- study, for example, quotes that the -- in terms of risk from the transportation side, PM makes up about 70 percent of the risk. And the other toxics are about 20 percent. I just ratioed on that number for this analysis.

MR. LYONS: Okay.

MR. JACKSON: It's really really crude.

MR. LYONS: Okay, thanks.

MR. JACKSON: And if I have to stand by it, I don't want to.

(Laughter.)

MR. JACKSON: Okay, why don't we move to the next presentation, which is going to deal with some of the economic factors. First of all I'd like to appreciate everybody for commenting. We appreciate your comments here. And if there's any other further comments, you can either contact myself or Susan Brown. Or you can actually submit comments to the docket. There's many ways that you can get ahold of us.

Our next presentation is going to deal with, if you recall again my little chart on this, the task structure here for trying to estimate what the benefits, the indirect benefits are.

One of the issues we wanted to look at is what's the effect of various strategies on the California economy. And for that purposes ARB has been using a group at UC Berkeley, Peter Berck and his group, to look at a modeling approach that will allow not only to consider the sort of legislative type changes, but how can we extend that now to look at some of the fuel related issues we want to do.

So, with that, let me introduce Peter Berck with the University of California at Berkeley.

DR. BERCK: Thank you, Mike. I'm told that this is simple enough that even a Professor can figure it out.

(Off-the-record remarks.)

DR. BERCK: So I would like to discuss how we plan to evaluate the statewide impacts of whatever fuel displacement strategies or fuel efficiency strategies are ultimately suggested in this project.

This work is joint with Peter Hess, who's in the back here. Hold up your hand for one second of fame.

(Laughter.)

DR. BERCK: And it depends upon also help from the State Department of Finance who helped me build the model that we're going to use today.

The task, of course, is to evaluate the likely economic economy-wide effects of petroleum dependence reducing strategies. And we'll do this in the context of projections for the California economy for year 2000, 2020 and 2050.

The basic method we will use is to use a computable general equilibrium model, which I will explain to you in a little bit of detail in the next few minutes, that we built for the California economy.

The model, which in this case is the

environmental version of the dynamic revenue analysis model, hence EDRAM, is a model of the entire California economy. It's parent model, DRAM, was constructed jointly with the State Department of Finance to evaluate large money bills and their effects on state finances.

EDRAM is a derivative model. It has pollution coefficient, which are not terribly important for what we're doing today, and it has a great deal more detail about the industrial sectors that are of concern to us.

The history of DRAM is that the State Legislature mandated a dynamic revenue analysis be performed on all legislation having a revenue impact of $10 million or more. And that was back in 1994.

Bruce Smith, who is the -- shortly thereafter joined the State Department of Finance, and then I and several of my colleagues at Berkeley, then built this model for DOF. It's been in continuous use by the Department of Finance since.

The documentation for the model is easily obtainable. In fact, there's a website, the address there, which would give you the

Department of Finance version. The version we're using differs very slightly.

The ARB version, which is the version we're using, has a sector that subsumes engines, which are the things that are used in cars, obviously. And also consumer chemicals. Because those two sectors were things that ARB was targeting at that point and wanted to know the effects of. The ARB version also includes some pollution emissions data.

There are a number of things about the model that one would put in the realm of, you know, uncertainties. One, of course, is that models such as this depend upon national IO tables. And this one is dependent upon the '92 IO table. DOF is in the process, as we're talking, of rebasing it to a later IO table, but I don't think that will happen in time for this analysis.

The migration data for the State of California is not excellent, to say the very least. And so equations that concern migration have a great deal of uncertainty in them.

Finally, there is no good source of data on trade between states, although there is a little data on trade between states. And so the costs of importing things from other states are not as well known as one might like. And that, of course, will be very important to us, because we're going to consider importing large amounts of petroleum products.

The major sources for the model are the national input/output tables, which are then supplemented by actual employment data in the State of California, and therefore scaled to the size of the State of California.

Demand, that is consumer demand, is estimated from the consumer expenditure survey, and we used the data set for the western United States.

Most of the rest of the parameters are taken from the economics literature, and are not California-specific.

The model solves for prices of goods, services and factors of production to make the quantity demanded and the quantity supplied of these factors equal so it is an equilibrium model.

Both physical goods and money are conserved in the model. That's important when you do environmental analysis, because if you think of a strategy that costs more money, a model such as this will insist it logically consistent that money actually be spent on something. So it's impossible to specify an experiment in which money is simply thrown away.

The basic structure of this model is that it has 77 -- the truth is it has 76. Tobacco is no longer a sector, but I'm going to omit that factor and just go with the previous version. So 77 distinct sectors. Thirty industrial sectors. That means all of the productive part of the California economy is broken into 30 pieces.

An example would be engines, petroleum refining, transportation, energy minerals, those would be examples of sectors that would be of interest to us.

There are two factors of production, capital and labor. There are seven different types of households which correspond to the seven marginal tax brackets in California.

There's one investment sector. There are 36 different types of governments. We could talk about that for several hours. And one sector that represents the rest of the world. The rest of the world, of course, is where things are imported from or exported to. And refers to the other states in the Union, as well as other nations.

In this model petroleum shows up in a number of places. The most obvious ones are refining, crude production, the import and export of both crude and refined product, the intermediate good purchases by a number of sectors, most notably transportation. So if you want to produce trucking as a service, one of the things that that service would buy would be petroleum. And then petroleum would be described as an intermediate good.

Purchases by consumers, which are very large use of petroleum. The significant direct tax effects of petroleum. Petroleum is heavily taxed and shows up in the state budget, of course. And the engines that are needed to use the petroleum. Those would be some of the major places one would find petroleum in this model.

This is your standard sort of what used to be Economics-1 description of a really simple economy. And it's worth talking through a little bit of it, very little bit of it.

Households, which are over on my side here, buy goods and services. We call that demand, the amount they buy; it's the amount demanded.

And in return they pay money, which we call expenditure. The other side of the top circle there, of course, is firm supply goods and services; and in exchange get revenue.

And so we have two different flows. One is product flows and the other is monetary flows.

Across the bottom side, household supply factors of production, capital and labor from which they receive their income. Firms, of course, demand capital and labor to make the goods and services. And the money which they pay we call rents or wages.

You can make much more complicated versions of these diagrams, and here is not the most complicated version we've made, but one that I think is good enough to get our point across.

Here we have the same diagram, and of course, we've added a bit. What's been added here, foreign households, which I'm not very interested in at the moment. Foreign firms and intermediate goods.

One of the things we're going to see, of course, is we're going to see foreign firms in the out-years producing an intermediate good, petroleum of various sorts. And selling it to firms as an intermediate good, selling it to domestic firms as an intermediate good. And so that would be an example of the trade loop in the model.

Foreign firms, of course, could also be directly providing goods and services to consumers. That would happen if they provided an entirely refined petroleum product.

The model accounts for both investment and migration. Immigration and emigration respond to economic conditions. So in this model if one does something that makes California a worse place to be, relative to the rest of the United States, then people will leave California. One can easily do that with tax policy, of course.

Investment and dis-investment respond to rates of returns. So, again, if California is competitive disadvantaged relative to the rest of the country, in this model capital will leave the state or just fail to be reinvested.

The model is equilibrium. And the equilibrium here takes something like three to five years, depending on what literature you believe to be achieved. The reason why is investment and immigration are not very fast processes.

A good piece of the investment process happens within two years, the very best piece. Immigration, on the other hand, there's literature that says that that may take up to about five years really to equilibrate. Again, the major part of it happens within three.

So if you're looking for the answer about what happens in a very short timeframe, then the runs that we'll do in this model will not capture that very well. So it will not give you a good answer for at least the way we're planning to use it, temporary supply disruptions, temporary price spikes, cyclical unemployment that's going to last a year, year and a half. These are not things that this model is meant to capture. It's meant to capture long-run phenomena.

Petroleum depletion does not show up in this model directly because there is no accounting for natural resources in the ground. How it does show up is in terms of cost increases for imports of petroleum products, or cost increases for petroleum products made here.

Base years. The way one uses a model like this is one specifies a base. Typically a base is a current year or very nearby year. Here the model had been based at -- the EDRAM model had been based at 98/99. The DOF model is now based a year later than that, and is going on two years later.

And in the base year one gets a very close correspondence of the transactions that actually occurred and the transactions that are in the model. In terms of those transactions that are recorded at the state level, they can be exact. In terms of those transactions such as inter-industry transactions that are recorded at the federal level, only every five years, they will obviously be an approximation based upon the federal numbers and state employment.

In 2020 we will be matching the projections for growth, population and state personal income that come from state agencies. And we have made the assumption that refinery will grow at not 1 percent, as it says here, but one-half of 1 percent.

This is the refinery pre process. It has been going on at 1 percent. We don't know how much longer it will go on at 1 percent. There are many people in the room who are much more familiar with that than I am. And the compromised assumption was that that will continue until 2020 at the rate of about half a percent. I believe that produces the equivalent of about half of one more refinery in the state between now and 2020.

The 2050 projections are, of course, way out. Here we've just continued the growth rates from 2020 to 2050 except for California oil production ends, and the refinery sector doesn't increase in capacity at all.

And that describes the basecases. And it is these basecases which we then use to evaluate the various scenarios of fuel reduction and the like.

And here are the basecase statistics. State personal income across the top in billions, B is billions of dollars. Population -- billions of constant dollars, by the way -- population in millions.

Consumption of refined petroleum product in billions of dollars. Here there is an interesting assumption between the current year and 2020. And that is that the price of raw petroleum will go up from about $18 to $22 and then stay constant there. And so a good piece of what you see in increased consumption is increased price.

Production in California, again, that's the base creep plus the change in price. Mostly the change in price, of course. And at the bottom I've put in the net refined imports. Today, of course, we are a bit of an exporter. By 2020, if one believes the consumption production numbers, we will be a bit of a net importer on this case. Not very extremely so.

2050 is more interesting in that we become a very large net importer if we hold our refinery capacity constant. And so we'd expect to see very much greater effects in 2050 of whatever policies we talk about than we find in 2020.

The four fuel scenarios, which are going to be described later in the program by Don -- am I right? Yeah, okay -- are fuel efficiency cases and fuel efficiency plus fuel displacement cases.

The rough way in which each of these can be evaluated is first to look and see where they have a direct impact. Consumer purchase of fuels, transportation, engines, because most of these things call for producing different types of engines to burn them. Energy minerals, and petroleum refining would be the most obvious places for direct impacts.

In terms of increased fuel efficiency in the consumer sector there are two important effects. One is the higher mileage effect. So if you make fuel more efficiency then each gallon fuel goes further. And that should be the dominant effect, at least one would hope.

But there is a secondary effect, and the secondary effect is that since each gallon of fuel goes further you get more miles for each gallon. Fuel appears to the consumer to do more of a job for a given price. And that will lead them to want to buy more fuel, or actually lead them to want to buy more mileage in that analysis. And, of course, more mileage would lead to more fuel.

Since the fuel is used more efficiently that will also change the demand for all other goods. Fuel now appears to be cheaper to the consumer after they have bought a more efficient car, or effective fuel does, or mileage appears to be cheaper, if you want to view that as --

So, the consumer sector, I think, is the most important here. And those are the effects one would see in the consumer sector.

In terms of the consumer, again, there's presumably a greater cost to produce the fuel efficient engines. And that is a cost that would have to be borne by the consumers who purchase them.

And there would, of course, another just basic effect would be a lesser demand for fuel by the transport sector, and by all other sectors that produce fuel, and therein hangs an interesting tale. And that is that in our statistics, our national statistics, the trucking sector is not as well isolated as one would like. So if a firm owns its own trucks, it doesn't show up as trucking. It just shows up at whatever type of good that firm makes. So, all sectors, indeed, would be producing -- would be demanding less fuel.

Fuel displacement. Well, presumably the greater costs of refining. There's a possible demand for ethanol. I put that one in not because I'm sure that'll be in the final example, but because it's easy to explain.

If we were to have a fuel displacement

scenario that called for ethanol, then the ethanol would have to be purchased from somewhere, and indeed it would be purchased from the agricultural sector. And the agricultural sector might well import more in order to meet that need.

One expects there to be further cost increases to engines for fuel cells and other things of that sort. And there's possible increased capital requirements for refineries. And when we get the actual scenarios pinned down then we'll know which of these things are the ones that we'll be looking at.

Each of these scenarios is then going to be examined with changes in some of the basic model parameters. One of which is fuel prices. Another of which is the supply elasticity. And last of which is tax changes.

The supply elasticity ones I believe will turn out to be the most important ones. So the question there is if one were to conserve fuel in California one way or another, and therefore have to import less, how much of a price change for fuel would that result in.

The obvious extreme is it could make no difference for prices. Another extreme is that prices of refined product to California could be very sensitive to how much we import. And would be what you'd believe if you believe that would be very difficult to get an offshore refinery to make California type gasoline.

We will try the model with a number of different values for those parameters, and try to interpret what each of those cases means.

The model produces more numbers than one could ever read, quite literally, thousands. The ones on which I think we will focus are state personal income, employment, the revenues to the state general fund and the state special funds, the expenditure on fuel. And since we'll have the price changes, the apparent quantity changes in the amount of fuel. And determining which sectors have large gains or losses, if there are sectors that have disproportionate gains and losses.

And that's the basics on how we plan to do the economic evaluation, at least the economy wide economic evaluation.

MR. JACKSON: Will you take some questions?

DR. BERCK: Of course. Especially since I'm done. They'd have to go to lunch otherwise.

DR. TRINDADE: Sergio Trindade from SE2T International. Thank you very much for your presentation; very illustrative. I have three points.

You mention in one of your slides that there's a greater cost to produce engines. The question is whether over a period of time scale economics would play a role. In other words, if you have a larger output of engines, would that be reflected in lesser costs.

The second question is in another slide you show that there's a possible demand for ethanol from the ag sector. I just wanted a clarification, is this ag sector a domestic ag sector or a world ag sector?

And the last one is what we are really discussing here is security, isn't it? The possibility that California may be affected by shortages of fuel and the consequences of that. Is the economic model that you are discussing bringing in as an outcome an implicit price for security? In other words, population is willing to pay a little bit more for the ability to be secure in supplies. Or is this premium for security, something that comes explicitly out of the model?

Thank you.

DR. BERCK: How about standing there for a second because I didn't write them down. Just give me one word on the first question was?

DR. TRINDADE: The first question is scale economics.

DR. BERCK: Okay. The Energy Commission and ARB Staff will make an assessment of what additional costs there will be to engines. And I will then evaluate that. And I presume they will do a couple of versions of it, some with more and some with less costs.

The second one?

DR. TRINDADE: The ag sector will face an increased demand --

DR. BERCK: There are two ag sectors. There is a domestic ag sector and the rest of the world ag sector. And one will buy from the other.

The model is only at the level of an entire sector of agriculture. So beliefs about whether people would produce ethanol in California if there were a large demand or they wouldn't aren't going to show up very well.

What you'll se is as you try to buy more things from the agricultural sector it will be doing more importing. But you won't be able to trace it to which thing it's going to import.

And the last one is security, I remember that because that was towards the end.

DR. TRINDADE: Yeah -- good.

DR. BERCK: Yes. Another ten years I won't remember any of it. Now you can sit down if you want.

The answer is no. The model is going to give you the straight dollars and cents outputs. The objective of the exercise is to find out what the dollars and cents costs are of strategies that leave California less at the mercy of importation.

DR. TRINDADE: So it's implicit.

DR. BERCK: So, implicit. So you'll be able to say, okay, if you found a fuel displacement strategy, let's say we found the cheapest strategy to cut our imports in half, what will that do to state personal income, employment and everything else. That's the answer you'll get out of this thing.

MR. HOWELL: Steve Howell with the National Biodiesel Board.

I see in the third scenario, though,

you've got number 2 plus gas to liquids Fischer-Tropsch diesel. Have you considered adding biodiesel as a potential option in there in addition to Fischer-Tropsch?

DR. BERCK: Two more presentations from now will be the right time to ask the question. I'm going to be the recipient of these scenarios, not the originator. Okay?

MR. HOWELL: Okay, thank you.

DR. McCANN: Richard McCann representing Diesel Technology Forum. And Peter knows me quite well, having had to sit through a couple of his classes.

And you and I may be the only people who understand what CGE actually stands for in this room.

A couple of questions. One is on documentation. I have the 95 report that is put out. Has there been an update to that?

DR. BERCK: There are a number of other ancillary publications, and we could probably get you them. For instance, if you want to see the consumer sector after it was redone, there's a working paper on that.

There's also a working paper on the

environmental version, but I can give that to you in a minute. The minute is that it has consumers -- a consumer chemical sector broken out of chemicals, and it has a petroleum sector broken out of, I think, it was other manufacturing. It otherwise looks the same.

DR. McCANN: And so the parameter values are roughly the same as in '95, if I was in the back of the '95 --

DR. BERCK: Yeah, the parameter values for things like elasticity, substitution and life should be the same. But you can have the whole current model, it's no problem.

DR. McCANN: Right, I --

DR. BERCK: Send us an email and it's yours.

DR. McCANN: -- I actually don't really want to run it.

(Laughter.)

DR. McCANN: One thing I was struck by when I looked through the appendices was favorite number was 1.65 for elasticity, trade elasticities, things like that. Are you going to run any sensitivity cases on --

DR. BERCK: Yeah, the trade elasticities

are the things that change your numbers the most. That's exactly we're going to run the -- and it's the one number also that we are least sure of, obviously.

DR. McCANN: Right.

DR. BERCK: And we're going to run a lot of sensitivity analysis on that parameter, because that's going to change your results more than anything else. I've run the model enough now so I know where the answer is. The answer is in that number.

DR. McCANN: Right. And then on fuel demand elasticities, I don't remember seeing that in the documentation. Do you have that?

DR. BERCK: Yeah, the fuel demand elasticities for the consumers are part of, that's the estimation using the consumer expenditure survey. So it's a literal linear approximate estimation for the western United States for I think it was 12 or nine -- it's nine different commodity sectors, which is about all that can be done with that.

DR. McCANN: And that's in the '95 documentation? Or is it --

DR. BERCK: No, no, that was done after

'95.

DR. McCANN: Okay, so that's one of the pieces that we would have to get from you?

DR. BERCK: Yeah.

DR. McCANN: Okay.

DR. BERCK: That's the only interesting piece, frankly, that you want to get.

DR. McCANN: One thing that you probably don't have any control over but I notice that one of the scenarios was actually choosing the NRC's, one of their bounding cases on fuel economy. Rather than using the expected or average case.

And so this is kind of more directed at the staff, that I think that using a case that was clearly identified by the NRC as an outer bound on fuel economy is not an appropriate scenario to run in your analysis if you're going to choose a case to run. You should be using -- if you're going to use the NRC report, you should use it correctly, and use the expected case.

And if you're going to do bounding cases, use both bounding cases. Not just one.

And then finally --

DR. BERCK: I have the answer to that. Both is not a wonderful answer from my point of view.

(Laughter.)

DR. McCANN: I figured that. That's why it wasn't directed at you. One final thing is actually it dawned on me that there is one other use of this model that hasn't been raised, which is related to the previous comment about the risk of higher fuel costs, the risks that we're trying to avoid.

It seems that we could use this model to actually estimate the cost of the risk of exposure to price volatility in the petroleum market, running scenarios with high petroleum prices, and run that through.

DR. BERCK: If you do -- I thought about that a little, Rich -- if you do that you have to make sure that the model doesn't have its full degree of flexibility, because what it will do is it will spread that over everything in the world.

DR. McCANN: Um-hum.

DR. BERCK: Which it would over five years. And so that exercise would require certainly shutting off migration, shutting off investment and keep it as a short run. And probably fixing some sectoral capital and the like.

It's an interesting idea. I don't know if we'll reach it given the time scale involved. But that's how you do it.

DR. McCANN: Okay, thank you.

MR. KRICH: Ken Krich, Sustainable Conservation. Just a curiosity. Are you assuming there's no capacity constraints in 50 years, there's enough roads, there's enough ships to bring in all the petroleum we're importing and so on? Is there any capacity problems that come up in the model?

DR. BERCK: It's done backwards in the sense that in the basecase you actually successfully bring in a lot of petroleum. And then you ask what are the benefits from bringing in less. So, yes, you're assuming that the basecase is attainable. When we get there we'll know.

MR. KINNEY: Kevin Kinney, Coalition for Clean Air. When you were looking at the impact of the increased fuel efficiency in the consumer sector and you mentioned the secondary effect, which is basically consumer behavior being sensitive to price declines in a sense, I'm just sort of assuming that you're way ahead of me on this, but it's important, I think, that the assumptions that are made about the price sensitivity there in your model are sort of consistent with what's going on in the other modeling floor, consumer, price sensitivity that, you know, behavior in response to price increases as opposed to price declines.

And some effort to sort of make that consistent or to justify any differences with the other studies that have been done.

DR. BERCK: Our consumer numbers for demand are estimated off of real data and are the only examples I know of using the consumption expenditures survey for the western U.S.

So if somebody has something very different I think I would probably stand on my numbers and beg to differ with them. They're not cooked in any way, shape or form. In fact, when they were done fuel was not even on the horizon. So they're just a very straightforward econometric application to the actual data.

It's not like many of the other parameters where there are national studies and one has to choose among them. This was estimated for California and not for this purpose.

MR. KINNEY: So what does that show about that secondary effect? Is it a fairly minor effect relative to the primary? Do you follow what I'm asking?

DR. BERCK: Yeah. It's got to be because the elasticity, you know, the elasticity for fuel is not a very large number. The primary effect here is if you meant it as a demand for mileage, let's just imagine there's a composite good called mileage. What you're doing is if you double the fuel efficiency you'd be doubling mileage. And you would also be cutting the effect of cost of mileage in half. But since the elasticity is well less than one, the primary effect is going to dominate.

MR. KINNEY: Yes, okay, very good. Thanks.

DR. BERCK: And in order to keep it internally consistent you have to remember that that's going to have an effect on the demand for all other goods.

MR. LYONS: Jim Lyons, Sierra Research. One of your scenarios involves the use of fuel cells. And assuming that those are going to be operated on something other than gasoline, there will probably be an infrastructure cost associated with the distribution of that fuel. Does that come in on the price of the fuel for the fuel cell? Or is that something you have to build into your model?

DR. BERCK: If fuel cells ends up in one of the scenarios that we actually evaluate, and the scenarios are not yet fixed to the best of my knowledge, then that is going to come in as consumers purchasing that infrastructure, you know, for their cars from one of the other sectors. It's not going to be, you know, tucked onto the cost of fuel.

MR. FERGUSON: Good morning, I'm Rich Ferguson from the Center for Energy Efficiency and Renewable Technologies.

I'd like to go back to the question about the scenarios with the crude prices. And, again, as somebody pointed out, the purpose of this is to look at security issues. And certainly nothing in the EIA high price scenario or what the Energy Commission has done reflects sort of the issue of what could happen if, you know, there's a serious shortfall in world production.

I'm just sort of wondering, this is probably again a question more for staff than for you, but it seems like if we're really worrying about security, petroleum security issues, the high price scenarios have to go well beyond what the EIA is running on their high price scenario, what the Energy Commission has done.

I'm not talking really about volatility. I understand the problem the model has in dealing with that. But sort of a permanent high price scenario. And is that something we're looking at, or how are those scenarios going to be chosen, I guess, is the question.

DR. BERCK: Yeah, you can answer that.

(Laughter.)

MR. JACKSON: Maybe I should have Paul answer it.

DR. BERCK: Yeah.

MR. JACKSON: In the baseline case the Commission has looked at in the outyears, at least for crude oil, going from roughly the 1999 baseline, like $18 -- I think it was $17.81, to be exact, to 22.5; and gasoline going in the outyears being roughly about $1.64, diesel being $1.65.

Those types of numbers are probably okay for the 2020 type things, but in the outyears, then when there's really going to be some sort of a depletion of petroleum as a resource, those numbers probably don't hold much water.

And we're going to have to put in ranges that are going to simulate what we think might be in the outyears.

MR. FERGUSON: But you're still talking about the baseline things, but if you're going to run a scenario with the world oil insecurity kind of price, how would you determine what that scenario is going to look like?

DR. BERCK: What you do is California is going to be, in the outyears, the interesting here anyway, it's going to be importing crude. You change the price of the crude, you make the price of the crude 50 bucks. That's not a problem.

And we're going to try and --

MR. FERGUSON: I'm asking how are you going to decide what the price --

DR. BERCK: No, I'm going to --

MR. FERGUSON: -- you're going to be putting in here --

DR. BERCK: -- try with a bunch of different prices.

MR. FERGUSON: Okay.

DR. BERCK: And some of them are going to be quite high. You want a real world answer to it, what happens to California depends a lot on whether it's that answer, so it happened to everybody in the world, or it happens only to us.

MR. FERGUSON: And assuming that there's going to be some switching to natural gas I would guess that you'd want to look at various natural gas price scenarios at the same time. Good.

MR. POHORSKY: Hello, I'm Jerry Pohorsky, concerned citizen from Santa Clara. How many people know what this is?

It's a petroleum displacement strategy; it's a card that allows me to buy methanol fuel so that six out of every seven gallons in my tank is not petroleum. However, I'll give one of these to anybody that can take me to a place within 100 miles of here where I can use this.

(Laughter.)

MR. POHORSKY: Thank you. Oh, by the way, I believe well over 75,000 vehicles on the road in California right now that could use something like this. It's a huge under-utilized resource, and if you're going to come up with some strategies and displacement scenarios, I recommend finding how many of these vehicles there really are on the road and see if we can maximize the number of those that are using the alcohol fuel.

DR. BERCK: Thank you.

MS. BROWN: If there are no further questions, the only question I have is whether we come back 15 minutes earlier than the schedule predicts, which would be 1:15. What do you think? Yes? I see a lot of heads nodding.

So we will reconvene in this room with the presentation on national fuel economy at 1:15. Thank you.

(Whereupon, at 11:48 a.m., the workshop was adjourned, to reconvene at 1:15 p.m., this same day.)

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AFTERNOON SESSION

1:25 p.m.

MS. BROWN: We have two presentations this afternoon. First, Mike Jackson will be discussing some of the early results from our evaluation of national fuel economy cases. And then we may take a short break, depending on how we feel. And then Dan Fong is going to be presenting on behalf of the Energy Commission Staff some of the relative results from our evaluation of fuel displacement strategies.

I'm also suggesting that at the very end of the day we have a panel of staff present to respond to any questions you might have on any or all aspects of this project.

So, with that I'll introduce Mike Jackson.

MR. JACKSON: All right, thank you, Susan. What I want to do in this presentation is to try to present a methodology, and we're calling it the scenario model, but provide -- describe a methodology wherein we could compare some of the various fuel efficiency scenarios that have been put out there in the literature from the National Academy of Sciences or ACEEE, or whatever somebody wants to propose in terms of costs of the technology and improvement in terms of miles per gallon.

Okay, so what I want to do here is talk a little bit about this model and how we developed it. And basically it's just an accounting model where we're accounting for what the cost of the vehicle is; what the benefit is relative to fuel economy and MPG. And you have to make certain assumptions about what the California fleet is, how you roll in the vehicles. And we wanted to do them all sort of consistently so we could compare apples to apples with these various scenarios.

Then I want to talk a little bit about fuel economy and use; what the technology costs are; how do the various strategies compare; and then finally kind of bring in what we talked about a little bit this morning, how do the net benefits of various fuel economy strategies pan out on say a direct or total, direct and indirect, cost/ benefit type of analysis for the gallons displaced.

Okay, so light duty fleet. California light duty fleet composition. Really you have really two characteristics. You have the fleet that's existing out there, all those vehicles that is a mixture of new and old vehicles. And then for each year you have new vehicles that get introduced into the marketplace, or get introduced to the fleet. So you have to model both of those characteristics.

What we've done is to calculate these things annually to include new vehicle sales and existing vehicles. So each year the fleet kind of changes. The old fleet changes because you're bringing new vehicles in; the new fleet changes because you're bringing new vehicles in.

The model includes vehicle age and subsequent changes in vehicle use and population. And I'll show you how those figures are determined.

Also it calculates fuel use, fuel savings, incremental costs and direct consumer benefits. By direct consumer benefits, that is the savings or the cost for using these various technologies.

And all these scenarios here, most of them are looking at fuel prices in the $1.64 gasoline; this is only gasoline, light duty analysis. We didn't do anything on heavy duty in this particular case.

Where you're varying the gasoline price by one, so it goes like from a low of $1.47 to a high of like $1.81, something like that.

Okay, what does the current fleet look like. What's shown here is distribution in terms of percent. And across the bottom are the various cars. So pretty hard to read back there in the back, but it goes from -- hard for me to read up here -- minicars, subcompact, compact, midsize, full size, sports car, compact pickup, standard pickup, minivan, standard van, mini SUV, compact SUV, standard SUV.

You see that the vast majority of the population is in the subcompact, compact, midsize vehicles. But you see some fairly large distributions out here in the SUV range.

And this is for today's population in California. We said this before. Once you're born in California, our population is about 30 million, so when you're born you get a car and a parking place.

23 million is our vehicle population and of that, right now the existing fleet is about 60 percent passenger car and about 39, 40 percent

light duty truck.

What happens in the new model years? Well, it looks somewhat similar, but you see a large increase out here in the SUV population. So it's growing. In terms of light duty trucks it's now about, our projection for 2001 or 2002 is about 55 percent are pass cars, 44 percent are light duty trucks, with the growing out here in the SUVs.

We have, in our model, assumed that this distribution, in terms of vehicles, stays the same for every model year. Doesn't change. Number of vehicles changes, but this distribution does not change. That's probably not too bad of an assumption, but that is an assumption.

This shows you need to look a little bit at how long the vehicles stay into the fleet and how much they're used. And that changes both with as the vehicles get older and older, some go out of the fleet, and they're also used less.

And you can calculate then the VMT depending on how many vehicles are there and how much they're used.

What we've also assumed here is that each model year is assumed to age identically. Is that a good assumption? Well, it's not too bad. For example, this shows impact, this is impact 2000, so it's the latest modeling, it shows the population fraction as a function of years. So you can see that the newer cars, 1998, tend to be higher on this. In other words, tend to stay in the fleet longer, the early years. As you get out here they're not much difference.

But roughly at 20 percent you're talking about, you know, close to 20 years that these cars are lasting in the fleet.

You can do the same thing by looking at what the VMT is for these various model years. And you can see that as the cars get older, according to the model, they're driven less. Intuitively that seems right, too.

Then you can combine these two things as really the product of the scrappage and the product of VMT, and you can come up with a factor that basically says you can have a fuel use fraction as a function of years.

So, at a given year, for example, if you're ten years out, then the amount of fuel you're going to use because some of your vehicles have gone away, and because some of your vehicles are driving less, is going to be 60 percent of what it was when it was brand new.

So you have to account for those kind of factors when you are tracking fuel consumption for the entire fleet.

All right, let's talk a little bit about fuel economy and use. Potential fuel efficiency technologies, there's an uncertainty in the long-term projections of the various technologies. Especially those technologies that are less certain today.

Take hybrids, for example, those are all projections. Even some of the near-term technologies are somewhat guesstimates by various analysts.

So, what we believe is that you've got to consider a range of the various technologies to try to bound this issue.

The results presented here are based on two pieces of information that are in the literature. One is the work that's been done for the Energy Foundation and ACEEE, generally referred to as ACEEE results. Technical options for improving fuel economy of U.S. cars and light duty trucks. That's a fairly detailed analysis of trying to look at various segments of cars; doing a ground-up engineering type of analysis; and trying to match the performance characteristics of the cars; and then tracking what the costs are and what the fuel economy benefits are.

The other approach, what people have talked about a lot, is the National Academy of Sciences report, often known as NSA CAFE report. Similar types of analysis where they went and talked to the manufacturers, talked about what various technologies could be applied to what various vehicles, and what sort of improvements you'd get. Costs and improvements.

Each one of these sort of can give you bounding cases. And, again, what we're trying to do is figure out where in the continuum these sort of things fall into relative to what are the benefits of going with higher fuel efficiency standards.

What we have done to try to just compare apples to oranges is to say, okay, let's assume that in 2008 we have new vehicle standards; and let's assume that year and every year thereafter that every model year, every new car in that model year applies this technology 100 percent.

Okay, unrealistic penetration scenario. Understood. Just an apples to apples kind of comparison again to give us the limits of where we are.

It gets complicated. There's lots of numbers to put in here. This shows, for example, all the classes of cars in these various reports. It shows, this is the baseline that's currently in the California Energy Commission work. This shows the improvement that you would get going from this baseline to the ACEEE moderate, whole list of technologies for each one of these. And we've made some assumptions here.

Because ACEEE, for instance, does not have a category for mini SUVs, compact SUVs and standard SUVs. They made an assumption. Some cases it's conservative, some cases it's not conservative. But in general, it sort of fits. You can go through all those categories later, if you want.

So you have moderate and you have vans, you have mild hybrid, you have full hybrid. All those are ACEEE results. And then we picked another one from NAS, path 3. There is yet another case which we haven't put up here yet because we're not done with it, but it's CALCARS case 1, which was described last workshop. That's going to even be more conservative in this path 3 case.

And you can see what the different onroad fuel economy is, and then what a CAFE would be, using the different standards.

So, onroad, the baseline is about 20.8; the moderate would jump to about 36; the NAS path 3 jumps to about 31. On a CAFE basis that's 37, 8, 31. And on a CAFE basis this is about 43. And you can see all the in-between ones.

Okay, baseline. Basically business as usual. It was discussed completely last time at the workshop. There are some hybrids included in it, but not enough to really matter. The ACEEE -- I'm just trying to give you some ideas of the types of technology they're talking about here -- the moderate does include some weight reduction; streamlining; lower resistant tires; high efficiency engines. They're talking about 50 kilowatts per liter.

Integrated starter generators, 42 volts. Continuous variable transmissions; five-speed automatics. That kind of technology is included in the moderate.

The advanced has the moderate plus additional mass or weighting decreases. DI gasoline engines. Some people could snicker on that, but possible. And efficiency optimized transmission settings.

Mild hybrid, you're starting to put in some of the hybrid technologies. Rated at about 15 percent of peak power. And you would get about 15 to 18 percent fuel economy improvement over the advanced package.

And then the full hybrid is going way out in terms of electric drive propulsion rated at 40 percent of the peak power, and much bigger fuel economy improvements.

The NAS path 3 is one of the highest National Academy of Science's cases, fuel economy gains, associated with what they call emerging technologies, sort of off-the-shelf. Available in 10 to 15 years. And I should quantify what I mean by off the shelf. Still will require additional development before commercial induction, but fundamentally sound.

And then there will be another one here which will be more of a more conservative NAS, which is the case that we ran before, but it's not shown here in this particular assumptions.

All right, so what happens. Here's the basecase. Again, this is gasoline only; it's light duty. So we're at about 14.2 billion gallons, 2001, 2002. And you see this going up towards 30 billion gallons in the 2050 timeframe.

And you can see that these various cases kind of clustered. Again, nothing happens until 2008. You start introducing the new technology into the fleets and let's pick the most aggressive. Here's the full hybrid. Follow it out. It continues to decrease in terms of consumption. Then as population increases it will start to turn back up. Not a surprise.

And you can see, let's pick the moderate ACEEE case, which is shown here in the green. Goes down here, kind of levels out. And then as population, vehicle population takes over in the 2030 timeframe, tends to run back up again.

You can see the NSA path 3 and the moderate in terms of fuel displaced is about the same.

All right, that's only one part. The other part is how much does it cost to get you there.

NAS technology cost estimates were obtained through meetings with the various auto manufacturers, component suppliers, published references. Costs were then marked up to take care of all the transactions to get a retail price.

ACEEE, sort of the same thing, but probably more based on literature review and some industry estimates. And a major assumption of high volume production.

Again, costs were marked up through the various transactions to include overhead, marketing, profit, et cetera, to get the price.

Both of these assume large production volumes; more on the national scale than they would be on a California scale. So, as such, any California-only measure can only result in higher costs compared to what these things are showing.

Here is just an example. I didn't throw all the costs up here, but again, take the moderate ACEEE. Here was the miles per gallon that you would get, and here's the cost to get that technology.

And you can see that ACEEE, at least in

this comparison, tends to be lower cost than the NAS path 3. So, for higher fuel economy on moderate, but remember in the total fuel displacement it got about the same fuel displacement. So these average on-roads don't necessarily -- are in the long run pretty well wiped out when you introduce them as a fleet.

The major difference is going to be in the cost of these two columns here. With ACEEE being roughly a factor of two in some places. And cheaper than the estimates for NSA path 3.

You can also look at this from not only societal's point of view, but you can also look at it from the individual's point of view. Here, with the discount rate of 12 percent, we're showing some of the payback for two classes, mid size and standard SUVs.

And you can see that the baseline here on the mid size is 22 miles per gallon, and we apply moderate and advanced technology with the costs that are for ACEEE, we get payback of two to three years. Probably acceptable to consumers.

The mild hybrid and the full hybrid are six years, and probably infinity. Never pay it back.

And NSA path 3 is fairly high, and that has to do, again with the high cost and relatively low fuel economy for this class of vehicle. It's not true with all vehicles, but it's true with this class of vehicle.

Baseline is shown here. Again, sort of the similar thing you see that for standard SUVs you can see that typically right now we're at 13.8 in the baseline. Fuel economy improvements. Here you get better payback periods because you're basically saving more fuel, i.e., you've got a bigger jump from the baseline to any of these cases in here.

Again, that points out another strategy that you might want to look at relative to fuel efficiency standards, is maybe you don't go after those cars that have the highest fuel economy right now, but you go after those cars that have the lowest fuel economy. Something to think about.

Now, all the results presented at once. Overwhelming, probably, but what we've shown here is moderate and advanced, mild hybrid, full hybrid, all ACEEE compared to the NAS path 3, and this is cumulative petroleum reduction.

So these are billions of gallons, 3.6 billions of gallons, for this timeframe. Now remember, it doesn't start implementing until 2008, so you only have two years here.

Then you count all the fuel reduced between 2002 and 2020, that's this timeframe. Then you go up another ten years, another ten years, another ten years.

So, you know, in the extreme here, out at 2050, pick a full hybrid, you have displaced something around 500 billion gallons of fuel. That's a lot of fuel.

All right, you can also compare that to the cost. And what we've used here is a 5 percent discount factor, again looking at it from a societal point of view. Gasoline at $1.64 per gallon, and in this case we're showing savings, right. So positive is good; negative is bad.

Not surprising in the early years, the first years, you get negative results. Costs you money. As you go out in years, you save money. And the cheaper the cost of the technology, compared to its benefit, the higher the savings you're going to get.

So, for example, full hybrids out here,

the savings isn't nearly as much as what it is for a moderate. Gives you some ideas of cost effectiveness as it comes up.

All right, so how does this all compare? When we look at the fuel reduction benefits, we've got to look at both direct and indirect, as well as the technology costs, as I said over and over again. There's several ways that we can look at this.

We can do fuel petroleum savings potential in gallons. We could do direct economic impact, including consumer benefits over cost. We can do cost effectiveness. We're only going to show you a couple here.

What we chose to do is to say what is the direct net benefit, again positive is good, negative is the cost, what is the direct net benefit cumulative fuel savings divided by the gallons displaced.

Now, this is only one metric. You could have a really good direct net benefit and you could have it out here, but it may not displace very much energy. So you have to keep that in the back of your mind, too.

So what's shown here, and this is for

one period, this is at 2020, what's shown here is that the moderate is more cost effective than the advanced, is more cost effective than mild hybrid, is more cost effective than the full hybrid. And that's the NAS path 3 is somewhere in here.

So maybe the real range is between what NSA path 3 is, and what this moderate is in terms of what the uncertainty is. And, again, the low here is $1.47 a gallon; the high is $1.81 a gallon; $1.64 is about right in the middle.

This changes slightly as you go in the outyears. Things become more cost effective. You have more time to pay back. You've rolled more vehicles in. And you can see that things get very close to the payback period in these outyears.

Just to give you an example of how this works relative to there's net present value versus time. This is not really a surprise, either. Typical NPV analysis that you see that the higher costs never really pay themselves back, so here's the full hybrid which is fairly costly, at least in the numbers, and it never quite -- it finally gets out there maybe 2042, 2043.

And then the NSA path 3 is pretty far out, too, whereas some of these other ones which are lower cost, higher benefits, pay off real quick.

You could also look at it the same thing in terms of net present value. Again, savings, costs versus how much fuel is displaced, gasoline displacement in billions of gallons. So you can see some of these cost out a long time, even though they get out here at the higher efficiencies, but there's a net cost here until you get out to the cross-over point, where some of these strategies take off real quickly.

All right, now, if we take those results and we add in the net benefits we talked about this morning, roughly 35 cents a gallon for gasoline, what happens? Well, it tends to move, recall these were a little bit further this way in terms of cost, it moves everything to the right. Not at 34 cents a gallon, because it's all net present value.

But these numbers now are a lot closer to this break-even line than they were before. This is the 2020 case; 2030 case; almost everything is cost effective if you include the net benefits, which include the indirect benefits.

So that's where we are on this kind of

analysis. It kind of gives us an idea of how to compare these various scenarios on an apples to apples basis.

We do need to add in what we have been calling case one, which is a more conservative NAS case, so it will have less benefit, less costs than the NAS path 3. And then that will conclude the analysis done on this fuel efficiency type of analysis, which will allow us to figure out what types of fuel efficiency technologies and costs can we go after in this kind of a setting.

So, I'd be happy to answer any questions you might have on this particular analysis and where this is all going.

Sergio. Please state your name and --

DR. TRINDADE: Sergio Trindade, SE2T International. Thank you very much, Mike, for the presentation. A very complex set of data that has to be analyzed.

But, you know, the ultimate fuel economy in terms of gasoline and diesel is not to drive at all. In other words, I know this doesn't go well in this land, but if people would find other ways of doing things that would not require so much driving, you would have perhaps a major impact.

Which leads me to question, is the management somehow part of these analyses, or will be part of additional analysis in which other let's say policy interventions could stimulate an increased savings via demand management.

And then on -- I know when one develops these analyses it's very difficult to make decisions on what to take and what to keep out. Your profile of the fleet and keeping it stable is a very simplifying hypothesis, which is important, but it would be useful to, if you adopt that as a definitive profile of the fleet, if you would make a comment on the rates of penetration of these various vehicle types.

If you would plot this graph with penetration rates rather than absolute values you would see, perhaps, a very different picture in which perhaps SUVs would be the dominating element. And that has a tremendous impact on all of the conclusions, especially if SUVs outside the CAFE regime, or if they are inside, but with a different level of fuel efficiency.

It's a hard task, and you have to make simplifying hypotheses, but I think these matters ought to be considered.

MR. JACKSON: Thank you for your questions. There is a whole section in the strategies on demand management. And there's pricing strategies that are included. We didn't talk -- not going to talk about them much this time. We did talk about them in the last workshop.

And, in fact, the model that's being used there is not a scenario model, it's more of a consumer preference model that is called here at the Commission CALCARS. Which has built into it some of the consumer preference elasticities that would allow the distribution of the vehicles to somewhat change depending on attributes of the vehicles.

And it turns out we've looked at that model and the distribution, although it changes, doesn't change radically. Not a surprise, either, because you need to have some sort of data that would tell you how to change it. Nobody's going to know how to change it in the future. It's based on what's done in the past.

So we try to make sure that we're matching all those things. And we'll look at this rate of penetration issue.

MR. POHORSKY: Hello, again. Jerry Pohorsky, concerned citizen from Santa Clara. I would like to suggest use case number six. Most of the ones that you've mentioned so far are based on body style, not the fuel source.

The car I drove up today, unlike the electric car I drove last time, this one is called FFV. It's a flexible fuel vehicle, that's what FFV stands for. And they're available in a variety of body styles.

I have a four-door sedan, a Ford Taurus. But I've also seen station wagons and both large and small pickups. And GM and Ford have both announced that they're going to make tens of thousands of SUV FFVs in the 2003 model year.

And this is not an emerging technology; this is existing technology. And so as a displacement strategy, up to six out of every seven gallons in the tank can be nonpetroleum alcohol fuel.

And the savings here, to me, seem huge. It's something that I think your model ought to include this case, as well.

Thank you.

MR. JACKSON: Thank you, Jerry. What

we've shown here is only the fuel efficiency type of strategies. Dan Fong is going to get up next and show you exactly that strategy you're discussing.

DR. FRANK: My turn? Andy Frank, Professor at University of California, Davis; Director of the Hybrid Electric Vehicle Center.

By the way, I noticed in your analysis of this entire analysis on hybrid electric vehicles, that you, of course, defined the mild hybrid and the so-called full hybrid, but glaringly you've left off the plug-in hybrid.

And I must say that probably the reason is you think it's going to be very costly.

MR. JACKSON: No, not the reason at all. In fact, it is one of our displacement strategies, which will be -- I don't know, Dan, are you talking about that one, too? Okay.

Hold that thought.

(Laughter.)

DR. FRANK: Okay, very very good. The important thing that I just want to point out is that the plug-in hybrids, and we've demonstrated this at the University, can really cost -- the cost increment can be very very small.

And petroleum displacement -- I mean new car displacement with plug-in hybrids could be easily 50 percent or higher. And plug-in hybrids would give you, you know, 60 miles of range.

I just want to point out to our other friends from the environmental community that the plug-in hybrid is just another alternative, and the alternative fuel is electricity. That's pretty good stuff.

Thank you.

DR. McCANN: Richard McCann representing the Diesel Technology Forum. I just had a question about the scenarios you put up the ACEEE, about five or six scenarios, and then the NAS path 3.

On the NAS path 3 scenario they have the high -- the low cost high MPG, et cetera, all the various scenarios. Which one did you pick of those three?

MR. JACKSON: We picked the low cost high MPG.

DR. McCANN: And that's the bounding case, rather than using the expected case that the committee had agreed was the --

MR. JACKSON: Right, but remember I'm

going to have another NAS case, which is even more conservative than that one.

DR. McCANN: Right, but in terms of if you're choosing from a report that's done by -- as part of a scientific study and they represent something as a bounding case of their expectations of what happens in the future, you should really either do an analysis that takes into account both bounding cases, or you should pick the expected case. You shouldn't just pick one expected case. That's really inappropriate analysis --

MR. JACKSON: Well, I'm picking two cases.

DR. McCANN: -- to do that. So, and then the other thing that I noted in the NAS study at page 66 is they've looked at the ACEEE studies, and basically already gone through and done a lot of that screening on that analysis.

Seems like you should use the NAS work to basically screen out the ACEEE scenarios to the extent that they're not appropriate. That these, in most cases they look like they're technologies that won't be available for a fair period of time, from the NAS' report.

I'd strongly urge you to work on

building on what research work has already been done to date by the NRC.

MR. JACKSON: Understand your comments.

MR. HOWELL: Steve Howell representing the Biodiesel Board. Question for you, and I'm not familiar with some of the models, to what extent is the penetration of diesels into the light duty market taken into consideration in the models that you used up there?

MR. JACKSON: On these, none. But there is a whole displacement strategy for that.

MR. HOWELL: That's incorporated in there?

MR. JACKSON: You'll see it the next presentation.

MR. HOWELL: Okay. Second question about regarding how the full fuel cycle energy balance works into these equations. Does it work into that portion of the model there, or does that work in somewhere later?

MR. JACKSON: What I presented this morning would work into these displacement. These are basically from, if you think about it, you're taking a vehicle and you're improving its fuel economy. So that means it uses less gallons of fuel.

That means you have less through-put on the upstream events. But the emissions, in terms of grams per mile, have not changed, even though it's using less fuel. It's still meeting the same standards.

So the only events that are really benefitting are the upstream side in these strategies.

So what I presented this morning is consistent with these kind of strategies. It's not consistent with going to an alternative fuel like hydrogen and fuel cells. Then you would have other events occurring. And you'd have to redo the analysis to cover that.

MR. HINDERKS: Hi, Mitja Hinderks, Litus. Is it possible to suggest that we might include in this latest set of comparisons one that shows a substitution of diesel for gasoline drive, because it's the most readily available option and it's the least expensive.

And in the case of light trucks, the fuel economy improvement is going to be substantial, maybe doubling efficiency. In the case of cars, it may be in the order of 35 percent.

Now, it's hypothetical; I'm not saying this could be achieved. But it would be interesting to see how cost effective that would be compared with the other options, and all the other options involved are greater capital expenditure.

So is there any chance of seeing, including in these comparisons, to see how the diesel substitution compares with other strategies like the modern hybrid and so on?

MR. JACKSON: Right, the chance is yes, the answer is yes, we are including it. And it will be brought up in the displacement strategies, which we talk about next.

MR. HINDERKS: Right. The second --

MR. JACKSON: So the chance is 100 percent.

MR. HINDERKS: Okay. The second question is these numbers are very interesting, and we're looking at quite significant cost benefits down the line.

Now, am I right in thinking that you made these analyses based on technology costs, the cost of the new improved technology versus the costs of the fuel not used? And you did not include any societal savings, cost benefits, which in the earlier presentation you indicated that there were quite substantial cost benefits in reducing emissions.

So, if you -- one of these models, for example, we suppose that we're saving 5 billion gallons of fuel; and then you go back to the earlier numbers, you can extrapolate the cost benefits, the medical and societal cost benefits, do you propose to include a combined set of figures which show the cumulative cost benefits?

MR. JACKSON: Yeah, sorry that was not illustrated so clearly. But I did include the societal benefits on the last two slides. Now, what you couldn't see is how much improvement that gave you. But --

MR. HINDERKS: Okay, right.

MR. JACKSON: -- I attempted to do that.

MS. BAKKER: Susan Bakker with the Commission. I just want to be sure, though, you did not use Peter Berck's model and add any --

MR. JACKSON: No, all I put in it, Susan, was the air --

MS. BAKKER: Right, and nor did you have VMT effects reflected, which would -- we are ultimately going to do, is that right?

MR. JACKSON: Right. Correct.

MS. BAKKER: Okay, I just wanted to check. Thank you.

MR. JACKSON: It was only the ones I included this this morning which were air emissions which included the criteria pollutants, the toxics, global warming and spills.

MR. LYONS: Jim Lyons, Sierra Research. On your payback table, I just want to make sure that that's something you did fundamentally different than the rest of your modeling, since you didn't seem to take into account the fact the VMT would decline as the vehicles aged, and it didn't look like you discounted back.

MR. JACKSON: No, actually they did decline in use and in age. So the fuel use number was taken into account when we did the pay back. In other words, on year one you got x gallons; year two you got less than x gallons, blah, blah, blah, blah.

MR. LYONS: All right. The VMT is indicated to be a constant 15,000 miles per year across all the technologies?

MR. JACKSON: It started out at 15 --

Nalu, how, did you do that?

MR. KAAHAAINA: It starts off 15,000; but it's a case --

MR. LYONS: Okay. Thank you.

MR. JACKSON: Okay.

MR. FONG: My name is Dan Fong; I work for the California Energy Commission. I'm going to be presenting some information about fuel displacement strategies.

So, this is a slide showing the content of my presentation this afternoon. I'm going to give a little overview of what we previously discussed in the workshop that we held in January, talking about the various petroleum reduction strategies that the Energy Commission Staff will be examining.

I will explain the methodology that we're employing for these fuel displacement strategies. I'll describe an evaluation tool that we developed that allows us to compare these different displacement strategies on a comparable head-to-head basis.

I'll show you some evaluation comparisons and results. And then we'll talk a little bit about next steps in our analysis.

In our previous workshop we described the different strategy groups that we were going to evaluate. They basically fall into four groupings. You heard Mike Jackson talk about a couple of the fuel efficiency strategies that we're analyzing, but there are additional strategies that are part of that group.

I'll be focusing my remarks primarily on the second group here called the fuel displacement strategies. But there are other strategies that are part of this analysis. They include pricing mechanisms, like feebates, raising the fuel excise tax, pay-at-the-pump insurance and such. And then there are these other strategies which are lumped, which include telecommuting, other demand reduction kinds of strategies.

But in the fuel displacement group, the analysis that we're proposing to use and have used is designed to try to measure, evaluate and then compare the value of these different strategies using a group of validated and uniform inputs whenever possible.

The focus of the Energy Commission's work is on task three. We're going to be estimating the nonenvironmental direct costs and benefits. That allows us to then derive total net benefits when combined with the outputs from the ARB's task one work.

The two approaches that we're going to use in our displacement strategies in order to derive these net benefits include an analytic model that Mike mentioned earlier. It's called CALCARS and it's based upon a consumer choice model.

And then secondly we are putting together scenarios where we hypothetically define future conditions. And then based upon those future conditions what might be the outcomes of those types of strategies.

Now, in this term that we tend to use called total net benefits, there are really two components. One, there are the direct net benefits, and I've listed here what some of those elements include. And so it's like consumer net benefits are part of the direct net benefits.

They also include impacts on government revenue. And then the environmental benefits are also part of what we describe as direct net benefits.

The major indirect net benefits,

however, deal with the economic modeling that Peter Berck will be performing as part of these different strategies.

Now, for the fuel displacement categories we are looking at really two market sectors and two fields. There's a light duty vehicle market, and that primarily uses gasoline. And then on the other side is the heavy duty market, and that primarily uses diesel.

So the fuels that we're looking at in terms of displacing in the future are gasoline and diesel.

The strategies that we're proposing to examine include two basic types. One, trying to advance the kinds of transportation technologies that are in the marketplace in the future years. And then secondly, looking at how nonpetroleum based fuels might enter the marketplace, as well.

This is a list of the current fuel displacement options that we are evaluating. Most of them fall in the gasoline displacement category. They include fuel cells. We have grid-connected hybrids, which are the same thing as plug-in hybrids.

We're looking at the use of ethanol in

fuel flexible vehicles. We're also evaluating what we call advanced battery electric technologies which are essentially electric vehicles.

We're looking at the use of compressed natural gas and light duty vehicles. The possibility of expanding the role of LPG in our light duty fleet. And then we're also examining the possibility of light duty diesels entering our marketplace in greater numbers, again displacing gasoline.

For the diesel displacement strategies we're focusing on three primary strategies. One is using advanced natural gas engines in heavy duty vehicles. We're looking at the potential application of Fischer-Tropsch diesel which is a diesel-like fuel derived from natural gas. And then we are also looking at the use of biodiesel in heavy duty vehicles.

Now when we look at these different strategies it's really important to try to make good assumptions; and the assumption that I'll describe are designed primarily to try to simplify these very complex potential futures.

We want a set of common metrics so that

we can really estimate the potential impact and the relative value between these different strategies. And then the third key element of these comparisons are a set of uncertainties.

In trying to look at the possible futures that might result from these different displacement strategies, we really need to focus on a timeframe for making these comparisons.

One of the difficulties in looking at technologies that aren't really a major part of today's marketplace is that they all tend to lie currently in a developmental phase. And in that phase their performance is likely to be less than a conventional vehicle, and yet their costs tend to be higher.

But over time, if those technologies continue to be developed, then their performance will go up, and their unit cost will go down. Eventually, if the investment is made, those technologies reach a time and place which we call a mature market condition. This is where performance is really more evolutionary in nature and cost reductions are more incremental. You won't see these very large step changes in either performance or cost reductions.

And so we're choosing to look at these fuel displacement strategies in a potential timeframe where they reach this level of maturity. And then we're going to try to compare their different costs and displacement potential at this mature market condition.

The comparison tool that we developed actually links the ownership and operation of a certain set of vehicles to a fueling facility that provides that set of vehicles with the nonpetroleum fuel.

We basically will select a vehicle population that can operate on the fuel. We link those set of vehicles to the fueling facility. We assume that all of the developmental costs have already been amortized. That those costs are really not part of this mature market condition. And that allows us to use some stable cost estimates for both the vehicle, the infrastructure, and the fuel.

Based upon the operation of this set of vehicles we can then calculate a revenue stream and a retail price for the fuel that will support the infrastructure that's needed to deliver fuel to those vehicles. We can then determine a net cost of savings per vehicle and a per unit fuel displaced. We will express these results in present value terms.

Now, in our comparison tool we have a whole set of key inputs. It includes the number of vehicles that are operating on the nontraditional fuel. Those vehicles have a certain annual mileage accumulation. They have a certain vehicle fuel economy. Based upon those characteristics we can calculate an annual fuel consumption due to the operation of that fleet of vehicles.

We assume a certain vehicle payback period and certain capital amortization rates for both the vehicle and the fueling facility. That allows us then to calculate a necessary retail price where the revenue stream then meets the cost outputs of a potential vehicle owner.

We input vehicle incremental costs and fuel costs, and we compare those costs against a conventional comparable vehicle, either using gasoline or diesel. And then whenever possible we allow our fuel prices to vary independently within one standard deviation from the basecase.

And in most of our fuel strategies that

standard deviation is something on the order of 17 cents a gallon, plus or minus.

Now, the key outputs from this comparison tool is the following. We can generate numbers that express incremental annual vehicle capital costs per vehicle. The units of that number is in dollars per vehicle year.

We can also show incremental annual fuel costs or savings per vehicle in dollars per vehicle year.

But the two key metrics, I think, are the consumer costs or savings in a net present value per vehicle expressed in dollars per vehicle. And then secondly, what is the present value of net cost or savings per gallon of gasoline or diesel displaced, in dollars per gallon.

Going to show you one of the key comparison charts, looking at a group of strategies designed to displace gasoline. So, the colored bars reflect the amount of gasoline that is displaced over the vehicle life. And we are assuming a ten-year vehicle life for these different fuel displacement strategies.

The solid line, which varies in a

vertical direction gives you an estimated range of either costs or savings. The dashed line is the break-even point. Costs or dollar values above that line are an additional expenditure where a consumer will have to pay more compared to the operation of a gasoline car. The portion of the line that falls below the dashed line represents a savings.

So there is a potential savings, depending upon the different cost ranges that you use to evaluate these different strategies.

Some of the noteworthy ones here are at the end of this graph. The last three strategies there, although labeled somewhat cryptically, let me describe to you what they are.

The last one, which is a GFC, that's a gasoline fuel cell vehicle. The next one to the left is a methanol fuel cell vehicle. And then the third one from the right is a hydrogen fuel cell vehicle.

Now, the reason why these technolologies all basically displace a similar amount of gasoline over their vehicle life is that they basically just replace an equivalent gasoline car. So whatever a gasoline car might consume over its life, if we just replace that gasoline car with a fuel cell hydrogen car, it's going to displace exactly what that gasoline car would have consumed over that same period of time.

But the real key here is that there are these cost ranges. And so for the consumer he's then faced potentially with paying a higher cost if he chooses to own and operate one of these vehicles using a nonpetroleum fuel.

On the other hand, if certain events happened in a positive direction where some of these incremental costs that we see in the mature market condition, if some of those incremental costs can be further reduced, then there is the opportunity to actually save money for the consumer.

For those of you who can't see this very clearly, the highest cost displacement option there for gasoline is the battery electric technology. That's the singular bar that rises well above all the other potential strategies.

Now, for a similar graph, looking at the heavy duty vehicles and potential diesel displacement, again the axis on the right is an indication of the annual fuel displaced by each vehicle. And then the axis on the left is the net cost over the vehicle life. And this is a consumer cost.

So, once again we have certain technologies which, in a mature market condition, are projected to actually save the consumer money. There are others, though, that continue to require additional expenditures on the part of a consumer.

The technologies that look the most promising, at least in this mature market case, are the natural gas based LNG and CNG cases for these very large over-the-road trucks.

We have a potential also of saving money depending upon market conditions for Fischer-Tropsch diesel, but currently our mature market case for biodiesel shows higher costs even in a mature market condition.

Lastly, we want to look at all of these different gasoline and diesel strategies compared in a slightly different way, although the information is very similar. Here we're showing net costs or savings per gallon of fuel displaced. And by net costs, we're including not only the consumer's cost, but we're also considering potential government costs.

And so once again we show a neutral point here which is marked by the line labeled zero dollars. And so all of the numbers to the right imply an additional cost. All the numbers to the left of that zero line imply a cost savings.

So, once again, out of the 15 different fuel displacement strategies that we're evaluating, we have a high of 12 that might cost more; and then we have ten that actually might cost less. They're also bunched together, although I think there are some clear choices here. And some key uncertainties.

The different colors that we're using here are trying to indicate some level of uncertainty. The candy-striped bars are an indication of technologies that really have to move a great distance in order to reach improved performance and cost levels.

In fact, the lower three bars, for instance, are for fuel cell technologies. And even though we're projecting fairly positive potential cost numbers for those technologies, we recognize that they have a long way to go before they reach those current mature market performance and cost levels.

And so there is additional uncertainty for some of these different displacement strategies, depending upon the current technology status.

We also have a set of displacement strategies, however, that we call near term, and that we feel that the technology status of those options are fairly well established; that they are beginning to compete in the marketplace today. And depending upon the price range of gasoline or diesel, they can actually become very competitive in near-term markets.

So, what are some of the key uncertainties in the mature market projections that we're making? Well, for some of the near-term strategies, we're making some assumptions about the pace that the incremental cost can be reduced. We're making some assumptions about how easily or how quickly infrastructure can be deployed to support those kinds of nonpetroleum fuel technologies.

We're also making the assumption that engines and vehicles are really going to be mass produced and made available to consumers in attractive vehicles. But then we also are making some assumption that consumers will actually respond to these technologies based upon the cost estimates that we're making for these mature technologies.

I think that's the most important uncertainty here, is how will consumers really respond to these technologies if they were offered in the marketplace. In fact, even if we were to fully neutralize those incremental costs, it does not necessarily mean that consumers would automatically switch from buying a petroleum fueled car to a nonpetroleum fueled car.

In fact, most of us believe that you're going to have to give the consumer some additional benefit that goes beyond a break-even cost to have these technologies enter the marketplace in large numbers.

For the longer term strategies, again those require some technical breakthroughs, where the performance of the car really has to improve to become much more competitive with existing conventional technologies. That's true for not only the vehicles, but on the fuel production side, as well.

And then lastly for these longer term strategies they really have to improve their cost competitiveness in order for us to project large volumes of these vehicles entering the marketplace in the long term.

So, what's next? Well, the comparison tool that we have gives us sort of a screening device to try to look at these different strategies in terms of what should we do first; what might we do next; and what are some of the longer term strategies that still generate great potential for displacing future gasoline or diesel consumption.

We now need to look at how these different strategies might actually enter the marketplace. And what I call here is a penetration schedule for these different strategies. What is it going to take in terms of investment or technological advancement to actually bring these fuel displacement strategies into a marketplace to where they can begin taking advantage of lower unit costs.

We'd like to be able to project what a high penetration scenario might be, as well as what a low penetration rate, so that we can bound the potential displacement and then bound the investment and costs that are tied to those different penetration schedules.

But we also then want to apply a present value calculation on the net benefits that come from that kind of a penetration schedule, and then lump those benefits in with the potential environmental benefits to come up with a total net benefit for all these different strategies.

But there are other important elements of our cost benefit analysis that we still need to better quantify, and that is looking at this characteristic called consumer surplus which can go up or down, depending upon how the market and how consumers respond.

And the simplest definition of consumer surplus is it's the difference between what a consumer is willing to pay and what the market price of a product might be. It's also a measure of sort of societal good. If we can increase consumer surplus through some action, then it ought to be a preferred action.

We're also trying to better estimate the incentives and investments needed for any of these displacement options to actually reach a mature market condition.

Then, lastly, we need to take into account the societal impact of various pricing policies that are likely to be needed in order to neutralize the long-term incremental costs of some of these field displacement strategies.

For example, incentives will have a total cost that is generally greater than the increase in consumer surplus. And if that occurs, then we need to be able to subtract that potential loss from the net benefits that we calculate for that particular strategy.

So, I'm now prepared to take any questions from the audience.

DR. TRINDADE: Sergio Trindade, SE2T International. A couple of questions.

In your gasoline displacement scenario obviously three possibilities as you mentioned, one of them electric vehicle. But two other are outside the charts, namely FFVs and CNGs for gasoline displaced.

The question is for clarification, in this chart is the FFV considered to consume E85 or what fuel would it consume?

MR. FONG: Yes. We're assuming E85

would be the fuel that goes into that fleet of cars.

DR. TRINDADE: The second point in question is if MTBE is phased out of gasoline in California, almost 6 percent of -- maybe less, but just ballpark -- about 5 percent of gasoline will be displaced by ethanol. That means that there will be a demand for ethanol in the State of California for the existing fuel configuration.

That suggests that perhaps other uses of ethanol could be considered in the light of what you're trying to achieve here, such as an ethanol fuel cell. Nobody talks about ethanol fuel cells for obvious reasons.

But the moment you have volume in the market, maybe that might be an attraction. I do understand it's not being considered, but I'm suggesting that perhaps it ought to be.

MR. FONG: Before you go on, in our fuel cell cases we have looked at the possibility of using ethanol as a hydrogen carrier. The comparison results that I've seen so far, though, make it very similar to a gasoline fuel cell vehicle in terms of its efficiency performance.

And the reason why is, you know, it

takes energy to reform the ethanol so that you can extract the hydrogen. So it's very similar in terms of the complexity of the hydrocarbon that a gasoline fuel cell car might represent.

DR. TRINDADE: But you have an allowance in your scenarios for technology developments, so perhaps that could navigate that curve.

Finally, are you planning to suggest any policy interventions to promote favorite scenarios that you are showing us?

MR. FONG: I doubt if I'll be able to voice a particular vote on that. So, the answer to your specific question is no. I personally won't be able to have a set of favorites. But at some point, you know, when the information is finally put together in a complete form, I think the results are going to be pretty clear.

DR. TRINDADE: Okay, thank you.

DR. FRANK: Hi, Dan. Guess I don't need to introduce myself again, but I have a couple questions.

Your fuel cell numbers that you have in your key comparison result chart show them relatively low compared to the pure electric vehicle class, are much much lower than pure electric vehicles. And I wonder how that can be, based upon what's known about fuel cells today, and what are the projected costs.

It seems to me all the numbers i've seen are three times higher than pure electric cars.

MR. FONG: Keep in mind again when I described the comparison scenarios here, we are assuming a mature market status for these various different strategies.

On the one hand we have much more experience and knowledge with respect to the all electric vehicle. We have fairly good numbers, I think, on what the battery costs might be, even under high production levels.

Yes, there's a lot of uncertainty on the ultimate performance and cost for these various different fuel cell technologies, but basically the performance and cost targets that all of these different R&D and developmental programs are hoping to achieve were the targets that we used in our mature market analysis.

That might be termed a leap of faith by some, but it's nevertheless some numerical information that we can use to make these types of comparisons.

I think the experience with EVs is there and we're using that experience. And unfortunately that experience shows a much higher cost.

DR. FRANK: What you've just said to me, I think I just heard, is you're comparing apples and oranges. And in order to do that fuel cell uncertainty bars should be much much larger. And that's not reflected here, and it gives people the wrong impression, I'm afraid.

Anyway, moving on to another question. I notice that in your key comparison results, chart 15, that grid connected hybrids are in a different color that you didn't quite describe in your talk. Is it a different color because of the cost of batteries, or -- it's not -- it wasn't clear, you didn't mention it in the talk.

MR. FONG: Right. Perhaps I should clarify that. There are sort of three different colors there, indicated on slide 15.

The candy-stripe were technologies where significant performance improvements are needed. Basically we feel that in order to reach those cost targets those kind of improvements really need to occur, but there's great uncertainty as to how well those technologies will actually hit those improved performance values.

Then there's a set of what we call near-term technologies. Technologies that we believe already have demonstrated good market competitiveness. And depending upon the cost of gasoline and/or diesel, they can either save you money or possibly cost you a little money.

And then there's this third category which we, I guess, characterize as sort of longer term technologies. Technologies that aren't quite ready to enter the marketplace in some large scale fashion.

And so I think, as you noted, the grid connected hybrids might be one of those strategies. Because there are currently no OEMs projecting the production of that technology.

We also see that in order for grid connected hybrids to reach a more mature market condition the battery costs really have to come down. And we're using similar projected battery costs that are used in the electric battery case that all come from the advanced battery panel results produced through the Air Resources Board.

DR. FRANK: Two comments. Thank you for

that. First off, if you want to talk long term, the fuel cell is really the long-term item. And it's characterized as near term, and that's, even though regardless of what the car companies say, the realistic guys really don't believe that.

Anyway, the second thing is the battery cost. Battery costs and battery improvements are continuing at still a rapid rate. And there has been discussions that metal hydride batteries would be the cost of lead acid batteries in the near future. And that makes a huge huge difference in terms of incremental costs, number one.

And number two, the plug-in hybrids are actually simpler vehicles than conventional cars, much to the disbelief of many people. But that's actually true. And this means that the costs of those kinds of vehicles can be very low, and much nearer term.

Anyway, I'm hoping that you can include plug-in hybrids in your study and try to -- I mean I'd be happy to chat with you further on the costs of components and so on. And much of this data was studied in the EPRI report. And the EPRI report also has a pretty good consumer acceptability. A portion where we interviewed 400 people across the country.

I'm hoping in your study you will be able to do something similar, or at least use the EPRI results.

And what that showed was 50 percent market penetration of plug-in hybrids is entirely possible even at the cost, last year's cost. This year's cost is even lower.

MR. FONG: Thank you.

MS. LYNCH: Good afternoon, my name is Elisa Lynch. I'm a Campaign Director with Bluewater Network.

And I wanted to make three points, some of which I put into writing in comments that I submitted last Friday.

First of all I'd like to reiterate the previous speaker's interest in seeing ethanol as a hydrogen source for fuel cells. According to a consultant report submitted to CEC late last year ethanol does perform similar to gasoline but is actually a bit more efficient and has lower technological risks. So I would like to see a detailed evaluation of that.

My second point is looking at greater

penetration of ethanol, which was also mentioned earlier, in light of recent auto alliance data on ethanol use in new vehicles, which shows that there are reduced NOx emissions compared to previous estimates, we'd like you to evaluate a scenario where there's a change in the predictive model that allows more use of ethanol, so you could look at E10, 10 percent ethanol in all of the state's gasoline.

We believe that this would result in at least a billion gallons of fuel displacement, or petroleum displacement by the year 2030. And if it was made from -- if this ethanol was produced from biomass resources in the state, would also bring the state great economic benefits. So we'd really like to see a detailed evaluation of that scenario.

And third, I would suggest that you also look at biodiesel use in light duty vehicles. If you're assuming that there's going to be increased penetration of light duty diesel vehicles, we'd like to see biodiesel used there, and evaluate what the feasibility of that would be, and the savings.

Thank you.

MR. FONG: Thank you.

DR. BEARD: Good afternoon, I'm Loren Beard from DaimlerChrysler. I noticed in the slide that you had the comparison of various technologies as gasoline displacements, but there wasn't a column for optimization of gasoline engines, along the lines of the things that the NRC has recommended.

Can you -- is that off the table? It seems to me that the NRC spent a lot of time studying that and they came up with some pretty good conclusions.

MR. FONG: Well, at the outset, the agencies involved in the study said, okay, in our basecase we're going to make the assumption that without any change in fuel economy requirements new vehicles will essentially be produced at the current standard well into the future. That unless there was some other driver we didn't necessarily see how we could then project what future vehicle fuel economy might be. So that establishes our basecase.

We are not looking at other specific scenarios where light duty gasoline technology might improve its fuel economy over current vehicles, with the exception of the more aggressive fuel economy standard cases that Mike Jackson discussed.

DR. BEARD: That goes to my third question and I'd like to go back to my second question. I've heard a lot of people here talking about fuel economy standards. And I'm wondering if somehow the Energy Commission or the Air Resources Board or the Governor thinks that the state does or will have the authority to set fuel economy standards. Because I'm not a lawyer, but when I read the law it says that they don't.

MR. FONG: Well, that's more of an implementation issue. Right now our results are looking at what might be the displacement potential and what might it cost to reach those displacement values.

The actual mechanisms or policies that might need to be adopted, well, that would be part of an implementation phase of any particular displacement goals that, you know, public agencies might eventually adopt.

I think your point is well taken regarding, you know, California's potential ability or inability to adopt its own vehicle standards. But that doesn't necessarily preclude us from looking at the potential outcome if there was a national change in those performance levels.

DR. BEARD: And my second question that was kind of a followup to my third being that our first option, or our first preference, I guess, at least in the mid term, is optimization of the gasoline engines, CVT, VVT, the kinds of things that were discussed by the NRC.

Your second, actually probably the most favorable of the things you showed there in terms of cost and gasoline saved was the light duty diesel. And I can tell you from people in Detroit talking about light duty diesels in California, there's not a hell of a lot of optimism that that's going to happen under the current LEV2 standards.

Can you comment on that, or is there some plan to make an accommodation for diesels in the State of California?

MR. FONG: Well, I think again, in that case we assumed a some kind of evolved technology for light duty diesels, where those technologies do, in fact, meet every other performance requirement that is placed upon a light duty vehicle here in California.

We continue to see that that technology is advancing, and I guess from an engineering standpoint I don't personally see any reason why that technology can't improve its emission performance.

Yes, it's going to cost some serious investment. There are, no doubt, engineering and emission control challenges to bring that technology to a level that is equal to current gasoline technology.

But as I said in the last workshop, in 1990, when the Air Resources Board adopted its first low emission vehicle regulations we thought that we had reached the pinnacle of emission performance at that time. And look where we are now.

DR. BEARD: I guess I would just comment that at least in Europe there's a recognition that the diesel, at least with current technology, is not capable of meeting the same standards as gasoline engines. And they have special categories for NOx emissions to enable the fuel economy benefits of the diesel to be realized by Europe at a time when we can't, because there is no known technology.

And I agree with you, we're working very hard on it in Detroit, but there is no known technology today that can meet either tier 2 or LEV2 standards which would avail the U.S. of the fuel economy opportunities that are being enjoyed in Europe.

Thank you.

MR. FONG: Thank you.

COMMISSIONER BOYD: Can I ask the gentleman a question about optimization of gasoline engines, because the question to Dan put him in the hot spot with regard to CAFE. I thought he handled that marvelously. I think if California can point out to the nation, if not the world, that the benefits of improving fuel economy with regard to the dwindling supply of transportation fuels, that's a positive thing. Even if we can't implement something.

But let me ask you, as a spokesman for the industry, what do you see the industry can do to put a higher priority on this strategy that you think is a good strategy? What can be done with regard to optimizing gasoline engine performance without there being a fuel economy standard increase or something?

DR. BEARD: Let me put it this way. We are, as I speak my staff is preparing comments to the National Highway Traffic and Safety Administration, and that's on a multiyear ruling to increase CAFE standards.

We have said that we favor instead of taking action to increase CAFE standards nationwide. And we are working very hard on that. And that's why we have an interest in diesel because we see that as the biggest bang for the buck. But we're also working on trying to make a diesel that will meet the emission standards.

But the short answer to your question is we're working very hard, we're engaged with NHTSA trying to come to, I think the phrasing is the maximum technically feasible fuel economy standards.

COMMISSIONER BOYD: With regard to gasoline as well as --

DR. BEARD: With regard to the fleet, yes.

COMMISSIONER BOYD: -- diesel. Now, let me address the policy issue with regard to diesel. I mean you raised very valid academic question about light duty diesels and the current status of standards.

As a long-time California policy person now, it is certainly true and probably remains to be true, that we're not of a mind to trade the public health attributes of certain engine and fuel combination performance for, you know, public health of the citizens of the state.

And until it's demonstrated that people can achieve protection of public health with whatever system is brought forward, then I think California's going to continue to pursue, you know, the most optimal approach for protecting the public health of California.

And you're right, that has resulted in a long-time situation where diesels have not been that competitive.

DR. BEARD: And I'm not creative enough to have a solution to that problem. And you'll notice I didn't use the word relaxation of the standards. We are not in favor of --

COMMISSIONER BOYD: Nor did I.

DR. BEARD: Yeah, --

(Laughter.)

DR. BEARD: We are not in favor of

compromising the health of the people of California in order to reduce petroleum consumption. We would like to talk about creative ways to accommodate diesels within the framework of LEV2 if that's possible. I think we would like to begin an engaged discussion along those lines.

COMMISSIONER BOYD: I'm sure my friends at the Air Resources Board would engage you in that particular discussion.

DR. BEARD: Thank you.

DR. McCANN: Richard McCann for the Diesel Technology Forum. Just want to step through a couple of questions, and I have a final point to make.

First one, you talked about using -- allowing the prices, slide 11, fuel prices are allowed to vary independently by one standard deviation. Did you do a Monte Carlo analysis, or what was your comparison? How did that work through your analysis?

MR. FONG: For the gasoline and diesel comparison prices, we basically just looked at the historical price highs and lows over the last five years. And then just calculated a standard deviation based upon those sets of data points.

DR. McCANN: Right, no, I understand that point. It's then the next step of how did you use that standard deviation in your analysis? The variation in the price.

MR. FONG: Well, we are comparing these different fuel displacement strategies against either gasoline or diesel. And so depending upon the fuel costs for, let's say, LPG, there's also a range in fuel costs that we assumed for LPG.

We then compare operating that LPG car against a comparable gasoline car, which is operating on gasoline that is priced within this one standard deviation range of gasoline.

And so there's what we call a low low where the low price of the LPG vehicle and fuel is then compared against the low cost of operating a gasoline vehicle at the low gasoline price.

And then we compare a low high and then a high low and so we try to bound the potential net cost that a consumer might see, depending upon the comparative option that is before them.

And so, you know, there are certain conditions we're at a low gasoline price; none of these things look very attractive. But then at a high gasoline price, yes, they begin to look competitive. And that's, we feel, a way to at least look at the future market with this sort of uncertainty, and just try to project where these displacement strategies might fall within those operating costs.

DR. McCANN: I think that's a good approach. The question I have is did you have any correlation coefficient between the fuels? I mean LPG is a good example, where the price is highly correlated with the price of natural gas and with oil.

MR. FONG: Right. I think we saw that in reality LPG is probably going to be linked very closely to the price of the petroleum fuel. And therefore, when our final report comes out we'll indicate that some of the cases that we looked at probably aren't that reasonable, that are not likely to really occur in the marketplace given what we see in the marketplace today.

And so it will reflect the point that there are going to be some fuels that are going to be linked to the price of either gasoline or diesel. And they'll tend to track them. And so you won't have these very broad ranges where the alternative fuel might be at a low price and the petroleum fuel is at a very high price.

DR. McCANN: Turning to slide 14 where you have heavy duty truck technologies. I was surprised to see the cost advantage that you give for LNG and CNG, having done a detailed analysis, myself, which shows completely reverse results. And I think I've sent that study to you.

And also having seen the results of South Coast studies which show net positive costs on LNG, or at least on CNG vehicles. And then also the difference on slide 15 that you have a CNG light duty vehicle as being very expensive, and LNG trucks being inexpensive.

Without being able to see your assumptions and things like that, what's the explanation for that?

MR. FONG: Well, for the heavy duty cases that we examined, the basic performance targets that we used to establish our mature market condition are the targets being used in the DOE advanced truck program.

And that's why I earlier said that that particular scenario does require some very aggressive performance enhancement. And therefore there's some significant uncertainty about the numbers that we're projecting for that particular market, mature market condition.

On the other hand, for light duty vehicles we know that there's going to be a fair vehicle incremental cost. The case that we're examining also includes a home refueling unit. And so there's the cost of that home refueling unit; there's the incremental cost of the vehicle which we believe is fairly well established, and not likely to go down over time.

And therefore, for that particular light duty technology there's this large incremental cost that must be neutralized if, over the ten-year life of the vehicle, that somehow fuel savings are going to defray that additional vehicle cost.

And so for the light duty vehicle technology it does look like it will require additional expenditures on the part of an owner of that technology.

DR. McCANN: And then finally I wanted to make sort of a more of a general policy statement which I may direct to Commissioner Boyd, which is about the MTBE issue and ethanol.

That with the MTBE phase-out we're going to be in a position where we're going to be requiring more and more ethanol imported into the state. And I did a study in '93 for the Air Board, and in '94 for the Energy Commission that basically pointed out that the amount of biomass that's available for ethanol production in this state is relatively minimal.

And that, in fact, because of the high value of production that we have with agriculture in California, that our production value per acre is probably about three times what it is in the rest of the United States per acre.

So, nobody is going to convert their agricultural land to ethanol energy fuels in California; it's not cost effective. So, we will always be net importers of ethanol for this state.

And in the near term we actually face a very high risk associated with the MTBE phase-out, which is that one company dominates the U.S. ethanol market, Archer Daniel Midland. I don't know the exact percentage, but I know it's well in excess of 50 percent of the ethanol market.

That company has been convicted -- had officials convicted of price fixing. Not in the ethanol market, but in other markets.

We do face the risk of facing the Enron of the ethanol market in California by relying on ethanol basically to produce ETVE and replace MTBE.

And I think that you need to strongly look at the issue of when you're displacing gasoline, what are the strategies that are available near term to reduce the market power that ADM will have in the ethanol market. This workshop is about addressing market power of oil producers. You don't want to jump from the frying pan into the fire.

And one of the strategies that is available to avoid having to deal with the ethanol market is pursuing diesel technologies, which are readily available, already on the market, all ready to go. And that they can be adopted immediately. That the European models can be imported to this country within a couple of years.

So that is one of the options that you should consider that in terms of your own market exposure, the exposure that this state economy has to a single actor in the U.S. energy market, that you need to pursue alternative strategies.

And I only have to say we learned our

lesson, I hope, from 2000 and 2001 what happens when you do expose yourself to a set of bad actors in the marketplace.

And with that I conclude. Thank you.

MR. FONG: Thank you.

MR. HWANG: Roland Hwang with the Natural Resources Defense Council. I have three recommendations on the section.

The first recommendation is I think we've heard from a number of people about the issue of diesels, light duty diesels, in our fleet, and we concur that we don't see the technologies are going to be available on a practical manner that will allow diesels to meet current standards.

And our position is also that current standards aren't sufficiently health protective of the unique hazards posed by diesel exhaust.

So our recommendation is that detailed analysis not be done at this time on the diesel pathway. Just like the National Academy of Sciences fuel economy report did not analyze using diesel to meet higher fuel economy standards, I think it's inappropriate for California to be analyzing it and making some assumptions either about modifications to current air pollution laws or making assumptions about breakthroughs in diesel control technology. That's our first recommendation.

Second recommendation is that the diesel strategy, as such, is not really a petroleum displacement strategy. It is, in fact, an efficiency strategy. We are -- the way I think it was characterized in your slide, Dan, it's a gasoline displacement strategy and diesel displacement strategies.

But, of course, if we displace gasoline by diesel we only have to increase our diesel production, so that's still a petroleum consumption. The only benefit in terms of displacement is through an efficiency gain by higher end use efficiency.

So, it's not really a displacement strategy; it's more appropriately talked about under efficiency. And even under efficiency it should be similar to what the NRC did, should be discussed as an option which maybe we can consider at some time in the future if the technologies are demonstrated, certified, can meet future air pollution standards. And if emerging health issues regarding diesel exhaust and regarding particulate matter are appropriately addressed in future deliberations by the Air Board and other public health officials.

The third recommendation is on the battery electric side. We feel that the current analysis seems to be to constrain, especially in the post 2010 timeframe. We do know that there is technical opportunities to reduce the cost of batteries by moving to different battery technologies.

And that if we're looking at a 2030 timeframe, it's overly conservative and overly restrictive to look at a single technology which my recollection or interpretation of the numbers that were shown here is probably based on a nickel metal hydride type technology. There's other technologies which can be -- coming out lower costs, especially in the post 2010 timeframe.

And also within the cost of the battery electric vehicle analysis there are, of course, other strategies to address the battery cost issue, namely looking at vehicles that have smaller battery packs that can meet the vast majority of people's driving needs.

So that, analysis of city cars and other vehicles need to be, I think, incorporated to give a fuller, more complete picture.

Thanks.

MR. FONG: Thank you.

MR. BURKE: I'm Andrew Burke from UC Davis. I have a comment, and then a couple questions about the hybrid.

Sitting here it reminded me that I started to work on hybrids in 1974 during the first oil shortage, and the intent there was to displace petroleum, because you could generate electricity by all sorts of things. By coal, by hydro and so forth.

And it seems to me that where hybrids looked the best from what I saw today was when you look at displacement.

Now, so the clock, it seems like we go around in circles. We start with looking to things for emissions, then we look at them for displacement. We look at them for lower fuel economy, and we just keep going around.

We're now back to where we were in 1974 in terms of displacement.

Now, on slide 13, the HEV that you have, is that a grid connected?

MR. FONG: Yes, it is.

MR. BURKE: Now what is it, it looks to me like the petroleum savings is really quite high there, and that is real petroleum savings. Some of the other ones you're just shifting from one type of fossil fuel to another type of fossil fuel, but if you're using electricity you have the opportunity to shift away from fossil fuels. So that's even better than it looks.

Now, the question is what different assumptions led to the big spread in the cost?

MR. FONG: Cost? Dave, do you want to help there?

MR. ASHUCKIAN: Actually the results of the cost there are used in the EPRI study. Considering --

MR. BURKE: Because if you take the lowest cost they look very attractive. If you take the highest cost they don't look so attractive. So obviously the assumptions made are pretty important.

MR. ASHUCKIAN: Actually for the grid connected hybrids we used the EPRI study on their grid connected hybrid data, the retail price equivalent for the vehicle is a 60-mile all electric range hybrid. I think the cost range was from $6900 to $10,030, or $300 incremental cost of the vehicle.

And then the cost spread is added to that based on the cost of electricity varying from 4 cents a kilowatt hour to, I think, 13 cents a kilowatt hour. And, again, the cost one standard deviation from the gasoline price.

MR. BURKE: But the range was always 60 miles, is that right?

MR. ASHUCKIAN: Yes, we used a 60-mile, all electric --

MR. BURKE: Okay.

MR. ASHUCKIAN: -- range vehicle.

MR. BURKE: So if you went to 35 or 40 it would -- the cost would even be lower, right?

MR. ASHUCKIAN: There's almost 100 iterations --

MR. BURKE: Okay, okay, --

MR. ASHUCKIAN: -- of electric hybrids that we --

MR. BURKE: That's why it --

MR. ASHUCKIAN: -- could look at --

MR. BURKE: -- it's so difficult to look

at these things and try to really interpret them when you have no idea what the vehicles were. No.

If you look at 15, again, the grid connected hybrid looks very good in the lower cost area.

So I would, my conclusion from looking at these results is that from, as I would have expected, from the petroleum displacement point of view, if that's going to be one of your key considerations I don't see how grid connected hybrids can't look good.

It's when you go to the charge sustaining hybrid that you can get one result or another result depending upon the cost assumptions you make. But if you look at it in terms of displacement, seems to me that, in my opinion, the grid connected hybrid has to look good. Because that was why it was designed in the first place.

MS. HOLMES-GEN: My name is Bonnie Holmes-Gen, and I came specifically because I wanted to comment on the inclusion of the light duty diesel pathway in your analysis.

And I wanted to convey to you that the American Lung Association is very alarmed and concerned about the inclusion of this pathway. We do not believe that there should be a pathway included that would promote light duty diesel vehicles.

One of the top priorities of the American Lung Association is reducing diesel emissions due to the serious public health impacts of diesel, which are very well known. And there is a range of symptoms. Some of those include increased asthma attacks and increased risk of lung cancer.

Even if engineering developments were to occur that could reduce a diesel PM emission so that vehicles did comply with emission standards, which they currently do not, the diesel particulate that would be released would still have the same toxic properties.

And we're almost assured that the emissions would increase over time. There's consistently been a pattern of end use emission increases from vehicles with emission control equipment. And we assume that same pattern would be repeated, so that we would not be assured that we would have those same low emissions they were certified to over time.

Including the diesel pathway is contrary to existing vehicle emission control requirements. It's contrary to CARB, the Air Resources Board, programs and directives to reduce diesel emissions. And we believe it is the wrong -- it is not an appropriate solution to pursue.

We think it would be unfortunate for the Energy Commission to include this in the document. And we certainly ask you not to include any further analysis of this option. And to focus your attention on inherently cleaner vehicles, and you have many of those inherently cleaner vehicle options listed in here, including battery electric and natural gas and other alternative fuel vehicles.

MR. FONG: Thank you.

MR. POHORSKY: Hi, Jerry Pohorsky, concerned citizen from Santa Clara. I think one thing, I mean you've got a very nice analysis that you do, but one thing I saw in someone's email the other day that looked kind of interesting to me was a way of analyzing all of these strategies by having the tailpipe rerouted so it comes out in the center of your steering wheel.

(Laughter.)

MR. POHORSKY: I think you'd get a much

different outcome. Now, I was in a restaurant the other day and I treated my family to one of these flaming desserts that was, I think, fueled by ethanol. And nobody held their nose or backed away from the table, so I'm not sure how that would work.

But, getting back to your battery electric vehicles, I was really disappointed to see how far out of line that looked with all the other technologies. And I don't know, because it's in a class by itself there's no combustion whatever in the vehicle, so maybe it deserves some special consideration or incentive or some way to offset the battery cost.

I've seen some analyses that actually separate the cost of the battery from the vehicle by leasing the battery or something like that. So maybe I would encourage you to look at some other creative pricing options to remove that huge delta in cost from the battery option of the vehicle so that it is, you know, a more attractive option.

Just yesterday I was showing my EV1 to someone and they were excited about getting one, and I said, well, after my lease runs out they're going to take it back and I'll never see it again.

And they were just flabbergasted. I mean these cars have the lowest drag coefficient of anything on the road. They're just, you know, incredible vehicles. Five year old technology that, you know, looks better than anything I've seen promising on the fuel cell front.

And I don't know how we can get these car companies to keep these things on the road longer because of their clear petroleum displacement factor and the clean air benefit. I just wish there was some way we could see forward on the Air Resources Board and in the Energy Commission to, you know, go promote these a little bit more than what we're doing now. I mean, rather than seeing more of them we're seeing less of them.

Thank you.

MR. FONG: Thank you.

MR. LARSON: Jim Larson with PG&E's Clean Air Transportation Group. Looking at page 13, your key comparison results, you mentioned earlier on this, the CNG light duty scenario that that includes not only the incremental cost of the vehicle, but the home fueling appliance.

When I looked at this chart it really

stood out to me that the fuel cell vehicle cost analysis looked quite low. Is there a hydrogen or methanol home fueling appliance associated with those scenarios?

MR. FONG: No, there's not.

MR. LARSON: Okay. On the next page, 15, the key comparison results, I was also surprised to see the Fischer-Tropsch diesel as a near-term technology. And I'm curious, is that based on known capacity to produce Fischer-Tropsch diesel at this point?

MR. FONG: There was an assumption in this mature market scenario where worldwide supplies of Fischer-Tropsch diesel would be adequate to meet our potential demand.

Fischer-Tropsch diesel is currently being imported into California, perhaps not on a regular basis, but it has been a blending component for California diesel here since around 1996, I believe.

So it's not something new. Yes, there are limited worldwide quantities. But there's nothing mysterious about the technology. It's a matter of economics.

The oil industry is, I think, from all

that we can see, is rapidly moving to develop opportunities around the world where they have good economic conditions and a potential market for the product.

California certainly has a need for that type low sulfur, high cetane, low aromatic diesel quality fuel.

MR. LARSON: And there are no engine modifications necessary to operate that fuel?

MR. FONG: None.

MR. LARSON: And lastly, are socio cost benefits included here in the consumer cost considerations or the heavy duty scenarios, or is that something to be factored in later on, because we did talk about that earlier on?

MR. FONG: Can you restate that again?

MR. LARSON: The socio cost benefits, are they considered in your cost benefit analysis at this point? Or will that be factored in later?

MR. FONG: Well, let me see if I can interpret that correctly. We are going to try to estimate what the consumer surplus change is for these various different strategies.

That consumer surplus would involve potential increased market penetration for a particular product, or a lowering of consumer costs if that product were to enter the marketplace.

We're also potentially looking at how to estimate the increased consumer utility that might come from that particular product.

And so, in one sense, yes, we're looking at how a future market might respond and what are the additional consumer benefits that would flow from that strategy.

We're separately examining the environmental kinds of benefits that might be produced if those strategies entered the marketplace and then displaced gasoline or diesel. And so in one sense, if you, you know, want to lump those environmental benefits into a social cost benefit, you can certainly do that.

MR. LARSON: I would include public health avoided costs, I guess, associated with the cleaner fuel.

MR. FONG: That is being examined in the environmental benefit analysis that was described earlier this morning.

MR. LARSON: Thank you.

MR. HOWELL: Steve Howell representing

the National Biodiesel Board. A question on your assumptions when you looked at the mature market conditions when you're specifically talking about biodiesel.

What assumptions did you use there as far as the pricing for biodiesel and diesel fuel and ranges in your mature assumptions for the biodiesel side?

MR. FONG: In the biodiesel cases, again if you could read our little charts there, we looked at both a B2 case, where all diesel or a fraction of California's diesel would contain a 2 percent by volume biodiesel content. And then we also looked at a B20 where our diesel fuel would have a 20 percent biodiesel content.

The mature market price case that we examined had wholesale biodiesel being marketed at $1.20 a gallon. We contrasted that biodiesel cost against a CARB diesel price that varied from our basecase, which was $1.65 plus or minus 17 cents a gallon.

MR. HOWELL: So you used $1.20 for your biodiesel case. If that's the case then why wouldn't this be lower in the mature case than beneath the line showing a savings, if your biodiesel is $1.20 long term --

MR. HOWELL: That's wholesale. And so when we factor in taxes, certain retail margin, you know, and certain amortization rates, --

MR. HOWELL: So, your $1.65 for the CARB diesel is with the taxes included and the $1.20 biodiesel is non-taxed? Taxes are about 45 cents, state and federal, combined, usually?

MR. FONG: Yeah.

MR. HOWELL: So I'd expect that number maybe to be a little closer than what it is here.

My other question on your chart number 15 where you look at near term and long term, and then technologies that you said earlier aren't really ready yet, was questioning why you have the B20 and the B2 and colored, and the technologies aren't really ready yet?

We're currently marketing B20 and B2 all over the country. It's available today. It's more of a question of economics. A lot of the things that you just said about Fischer-Tropsch are also true for biodiesel. And so was questioning and challenging your categorization of B20 and B2 on that chart.

MR. FONG: Okay. Good questions. I

think again because we assumed a mature market condition, we're assuming that the biodiesel that enters the strategy in this case comes from essentially a mustard seed resource. That resource, from what we understand, is still under development. And therefore, it's a much a more, in our minds, a longer term potential technology, and can't necessarily be considered a near-term form of biodiesel.

Yes, we recognize that there are other resources that are currently being used for biodiesel. But it's not being marketed at $1.20 a gallon wholesale.

MR. HOWELL: Well, the question on near term versus needing technology, is it a question of technology or a question of economics? Because the way I've understood it earlier that your distinction between near term and far term is more a question of technology and technology development than economics.

And the difference between the mustard seed program long term and utilizing existing resources is really more a question of economics than it is of technology.

The fuel specifications have just

recently been set with an ASBM for biodiesel; biodiesel can be produced from a wide variety of fats and oils, including materials that you have here in California. Significant cottonseed industry, significant animal industry as a potential source. Significant amount of used restaurant oils, which can all be used today potentially, you know, at lower costs in that, you know, in that cost range today.

So my question is on your categorization we don't really need any more technology to make biodiesel, you know, an option. It's more a question of economics. And that there are other avenues being looked at economically especially when you have the Senate energy bill right now which would make B20 or B2 very cost competitive compared to conventional diesel fuel.

MR. FONG: What's the limiting factor then that prevents biodiesel produced from mustard seed from entering the market in large volumes?

MR. HOWELL: For mustard seed specifically there is development that needs to go on on the agronomic side of things.

MR. FONG: Thank you.

MR. HOWELL: But for biodiesel as a

compound, there aren't any technology challenges.

MR. FONG: I understand that. Again, when we did this mature market case we assumed in order to achieve a low market cost for the biodiesel it would have to come from a mustard seed technology.

Yes, we can make it from soy beans, but at $2.20 a gallon, it's not going to be very attractive.

MR. HOWELL: Okay. Next question I had was on the energy balance and the question about how that works in there, biodiesel is kind of unique as the alternative fuels world goes, having a very positive energy balance. For every one unit of energy to produce the fuel we get 3.24 units out, through independent work done by USDA and DOE.

If we're looking at displacing petroleum fuels how does the energy balance and the fuel cycle balance come into play in these type of calculations?

MR. FONG: Well, unfortunately we are focusing on what costs the consumer sees. What costs might a government entity be exposed to if they were to adopt a policy that tried to neutralize some of these higher incremental costs.

So, yes, our analysis is somewhat limited, but we're tending to try to make these comparisons based upon those constraints, because we feel that we can at least make, you know, apples and apples type comparisons based upon those assumptions.

MR. HOWELL: I would highly suggest that, you know, if we're looking at trying to eliminate our dependence on petroleum-based products that we take a look at the full energy cycle of not only biodiesel and the other fuels, and make that an integral portion of the analysis.

MR. FONG: Well, from this morning's presentation you heard, though, that from the environmental side we are looking at all of these strategies from a full fuel cycle perspective.

And so if there are these other benefits that are related to the use of potential renewable fuel, then those benefits would be captured in that full fuel cycle analysis.

MR. HOWELL: Okay, thank you. Last question I had was I see most of the information up there focused on the transportation market. Have you looked at the other uses for distillate or diesel type fuels, such as industrial boilers, gas turbines, other electrical generation applications, and incorporated those into the analysis at all?

MR. FONG: Well, when we looked at the potential transportation energy flows for California, when you look at the barrel of oil and where that oil ends up, roughly 60 percent ends up in gasoline; roughly 10 percent ends up in distillate or diesel; about 20 percent ends up in jet fuel. And then we have a small fraction that goes into all kinds of other petroleum-based products.

And so from our perspective, if we're trying to really reduce the state's dependence on petroleum, we're focusing on those key fuel applications to look at what might be achievable in reducing the use of those fuels in those applications.

MR. HOWELL: Okay, so is there a willingness to look at some of the other applications, or are you kind of de-prioritizing that at this time?

MR. FONG: Well, unless they're of similar magnitude, it behooves us to really focus on where can we achieve the most significant reductions at an affordable cost level, and in a certain time period.

And so, you know, we have somewhat limited all of the various options that we might be able to look at. But we feel that the ones that we have chosen to evaluate certainly give our executives and policy makers a full slate of potential choices, many of which have very positive outcomes.

MR. HOWELL: Well, the main reason I ask is that there's some very recent testing that was just done by Brookhaven National Laboratory showing significant NOx reductions with biodiesel in boilers, specifically open flame applications.

I know NOx reductions isn't something we normally associated with biodiesel use, and over-the-road applications, but in these tests, done by an independent laboratory, we showed 35 percent NOx reduction with B100, pure biodiesel in boiler applications. That may tip some of the economics, you know, in the favor of those applications. I'll be happy to provide you a copy of those studies.

The last thing I wanted to share, and

I'm not associated with the ethanol world, but I am familiar with a lot of the ethanol applications, and the gentleman who spoke earlier from the Technology Forum was correct, ADM does hold a majority share in the ethanol world. That share is actually decreasing.

The majority of the ethanol plants that have been put in recently have been farmer-owned cooperatives. And that's been the majority of the source of ethanol production, increased production here over the last few years.

Expect that to happen and continue to happen in the ethanol world. We expect it to happen in the biodiesel world, as well. So just as a kind of point of clarification, there's growing interest in the farmers actually owning the plants rather than industrial companies.

MR. FONG: Thank you.

MR. HOWELL: Thank you.

MR. KOEHLER: Hi, Dan, Neil Koehler, Kinergy Resources. A simple question on your E85 scenario. E85 today, in the midwest where it's marketed, sells for at or below gasoline prices.

And, you know, so net it's tax benefit, which is passed along to the consumer, that's how you would expect it to be trading fairly close to gasoline values.

And I was just curious, the bar I see here puts it at something that looks significantly higher than gasoline. I was just curious what the assumptions were that went into the --

MR. FONG: Let's see, Gary, do you recall the specific prices there?

UNIDENTIFIED SPEAKER: No, I don't.

MR. FONG: Okay. I'm sorry, we're probably not in a position to specifically answer that question. But, you're probably right, the reason why the net costs appear high is because there was a higher than, you know, higher price for the E85 that was greater than the comparative fuel, which in this case was gas.

MR. KOEHLER: So just maybe you can check into that, because I think net the taxes, which does get passed on to the consumer, it should be significantly closer to the gasoline.

And then based upon the comments, I guess maybe that's a section later, but some of the other ethanol scenarios are being developed and will be presented at some later date?

MR. FONG: That's correct. An E10

scenario is now being evaluated. We hope to include that with the next release of public information.

MR. KOEHLER: Great, thanks, Dan.

MR. CLAPPER: Hi, Dan, my name's Bill Clapper. I represent SunLine Transit Agency, and I'm not here to add to your work, so I hope that I can compliment some of the work that you've been working diligently on for the Commission.

I'd kind of like to fill in some blanks on market penetration and pricing and other strategies, because I think that's where my prepared comments go to, and I will provide these by email.

Models, I think, are really great, and I mean that sincerely, that they're great. They are consistent, they're reliable, and they're reproducible. The only element that goes on the outside of that is it does assume, from what I've observed on the models today, it assumes a business-as-usual kind of activity that's going on in the United States. Whatever's happening today will be happening in 2008 out to 2020 and on outward.

Now, when SunLine started down its path

of alternate fuels, actually it started down for the environment. And since that time in 1992 that has changed to a national security issue, a public health issue, as well as economic reasons. And this is what I believe the Commission is trying to fill in the blanks on.

We think that any strategy does have the four components. It has the increased supply. It has the decrease in consumption, either through mandates or incentives. It has the development of a sustainable type fuel. And most importantly, it has an educational component.

When I was looking at the task structure nowhere have I seen in the task structure an educational component for the population of California.

SunLine believes that the natural gas vehicles offer obviously an immediate solution; and that hydrogen is going to be the key for a zero emission. And I think everyone's aware in this audience about where hydrogen fuel cells are these days. It's in that 2008-2020 time period.

Since we believe that education is the key to any alternate fuel program, now SunLine's speaking specifically for compressed natural gas and compressed hydrogen, but substitute the name of any alternate fuel in there, and when you give people the choice and let them participate in the solution, such as I'm doing right now in this process, then you have that educational level out there to help in the pricing strategies, the incentive programs and the market penetration which you're trying to achieve.

Renewable have to be a part of a long-term solution. Currently at SunLine we are generating hydrogen from solar power. And we are using it in fuel cell vehicles. Senator Barbara Boxer was there Sunday and drove one of the vehicles, actually punched the button and produced hydrogen, herself.

We also have a project that we just won a contract on to produce hydrogen using wind power. Now these are demonstration projects. They do work and it can be done, and we've done it.

But they need to be done on a broader scale so that it helps drive down the price, and increases the advancement of the technology.

So in order to hasten the transition to a hydrogen economy, remember that's my personal reason for being here, is we think the state needs to address the issues of codes and standards, insurance and permitting.

Because I'll tell you right now, all the incentives in the world, all the investment in private industry are no match for the local fire marshal who doesn't want a compressed gas in their jurisdiction or any other alternative fuel. We've been down that road. I know the fuel cell partnership is going down that road with another city in the local area.

It's the same kind of process; it's an educational activity. We need to help, and this is where the state comes in, help the cities to develop a model ordinance to be able to bring those alternate fuels online faster.

In SunLine's decade of experience with alternate fuels we've repeatedly seen that public policy is the most important factor in their acceptance. In 1992 our board of directors, all elected officials, mandated that we park our diesel fleet. And we did that on May 8, 1994. And they had mandated an alternate fuel.

And on May 9, 1994, the next day, we drove out of the parking structure on CNG buses and have never looked back. One hundred percent conversion literally overnight.

That policy level decision removed all debate from the management, from the staff, and from the local communities. We were directed to make it work, and we did. And that's kind of easy because the elected officials, who were our bosses, were right there, and we were also the operators. And we were able to respond immediately to that.

Since then we've logged 25 million miles on clean burning alternate fuels, but we couldn't have done it without infrastructure partners, and without educational partners. We had to educate the mechanics, the operators. As a matter of fact, we sent everybody, at that time 140 employees, including administrative assistants, to be trained in alternate fuels.

Now, if we can do it, anybody else in this state can do it.

Lastly, we urge you to be consistent in your support of this process. President Nixon on November 16, 1973, called for a reduction of our dependency on foreign oil in the early '70s in response to the embargo of 1973.

Thirty years have passed and we've doubled our imports. We will never have a commercially viable alternative to petroleum if we do not begin now. So, hopefully this will fit into your 2008-2020 models, and look at that strategy of the stable assumption. What happens if one of those oil-rich countries who may not like us is suddenly not there to provide that oil.

Thank you.

MR. FONG: Thank you.

MS. JONES: Hi, my name is Pam Jones. Thanks very much.

The report here is looking at a timeframe of 2010-2030 primarily, and also looking out further, but those are the practical time constraints. So it's a balance between kind of that near-term practicality and looking at long-term breakthrough.

But in terms of what's on the shelf, what can really make a difference, you have to look at what is available in terms of the technology, and what savings there would be.

Yes, diesel is a fuel efficiency strategy, and so is raising CAFE standards, and so are hybrid vehicles. Just because they are showing efficiency, and in this case efficiencies of 30 to 60 percent, doesn't mean that they should be summarily dismissed in a report like this.

The other thing to look at is the potential for market penetration. I mean how much of a big difference will this make. We don't have to look at hypotheticals to look at clean diesel light duty technology.

We have seen penetration rates of about 30 percent in Europe. Even in the '80s we saw 14 percent penetration in the State of California.

So, levels of technology availability, fuel efficiency and penetration are part of the tradeoff to consider. I don't suggest that it should be done in the absence of looking at emissions, absolutely it should. But I think it's interesting to note that within the past month Margo Oge of EPA's office of transportation and air quality, has projected a light duty diesel penetration rate of 20 percent by 2010, without lowering tier 2 standards. That's significant.

Lastly, in the emissions I hope that you all will provide the same scrutiny in looking at all of the strategies as you will in looking at diesel emissions. Because there certainly is new information coming out with regard to emissions from other technologies, including compressed natural gas.

So, be consistent in your application of your health analysis of emissions. Thank you.

MR. FONG: Thank you.

MR. BURKE: Andrew Burke, again, from UC Davis. I have a couple comments and questions about the EV. What was the range of the EV that you have -- that that cost data corresponds to?

MR. FONG: The range, meaning the mileage range?

MR. BURKE: Yeah, how far does it go?

MR. FONG: I think we based that case on current product offerings, so I don't have a number off the top of my head, but we're assuming that at some mature market level battery costs will be reduced something on the order to around $13,000 per battery pack. And that that basically is the entire vehicle incremental for that technology. It's all in the battery pack.

But we're assuming that other features of the car are very similar to features in a gasoline car, --

MR. BURKE: I would guess --

MR. FONG: -- with the exception of maybe ultimate range, which is still somewhat limited by the battery system.

MR. BURKE: I would guess that those battery costs correspond to a car at least goes 150, 200 miles. Because otherwise there's no way they could be $10,000 to $25,000 for the differential cost.

So I think that again when you're giving these vehicles, hopefully when the report comes out there will be a way that the person who reads the report can say something about the characteristics of the vehicle. Otherwise, the results are meaningless, in my view.

Now, second of all, if we look at fuel displacement, I personally was very disappointed when the Air Resources Board did not allow plug-in hybrids for the 4 percent of the ZEV mandate.

And I think when you look at it in terms of fuel displacement like you are here, it makes no sense at all not to include the 4 percent, the plug-in hybrid for the 4 percent.

So one of the things that could obviously be done quickly is the Air Resources Board could change their mind relative to where plug-in hybrids go into the scheme of things. And that would, I think, influence -- you said one of the reasons why plug-in hybrids were a long-term technology is because the auto industry hasn't done it. Well, the could put out vehicles like that tomorrow if they had an incentive to do it.

So that I think that, you know, you said you're not in the implementation business, but I think that one of the things which could be done is to make the plug-in hybrid part of the -- a really crucial part of the ZEV mandate.

MR. FONG: Thank you. Are we all tired yet out there?

(Laughter.)

MR. FONG: Well, thank you very much. Those are all very excellent remarks and questions, and I think again, as the speakers this morning urged, we want to hear from all of you who have an interest in this area.

We have an open period where your comments can be provided to us in written fashion. In fact, that's, in our minds, the most valuable mode of receiving those comments, so that we clearly understand the information that you want to bring to bear, or the perspectives that you believe are important for this analysis.

MS. BROWN: I have just a couple of brief closing remarks, and I can see from today's comments and the interaction we've had that you all recognize the enormity of the task that we've taken on.

And we actually appreciate the kind of input we've been receiving verbally. And as Dan mentioned, we'd encourage you to submit written comments on what you've heard today.

I have one last slide here. If I can pull it up -- here we go. We are asking, if you so choose, to submit additional written comments by the 12th, that would be two weeks from today.

And as Mike Jackson pointed out, we are aiming to have a staff report available for release by March 19th. We have what I'm calling a Fuels Committee hearing which likely Commissioner Boyd will preside over, and will involve Alan Lloyd, the ARB's Chairman, on March 28th, in which we will have a more structured dialogue on some of the larger issues and policy questions that have been raised.

And so our team will be conferring, starting tomorrow, on the larger issues. And we will get some form of a report out to you with the technical appendices that will involve some of the task three work that Dan Fong described, and some of the task one work that Mike Jackson has described around the 19th of March.

So that is our target date. It is an ambitious schedule. The work is enormous. It's somewhat complicated, as you can see from the presentations today, but we are very appreciative of the input we received and encourage you to submit written comments on the presentations today by March 12th.

We will be posting information on our website. All of the Powerpoint presentations today will be up on the web within the next couple of days.

And I guess I just have one last thing to say, and I'd like to recognize some of the members of our team who have been very active in formulating this work. Tom Cackette from the Air Resources Board; Paul Wuebben, who is working with us as a representative of both the South Coast and was on loan to the ARB for this project.

Chuck Shulock. Chuck, raise your hand, has recently joined our team. We also have

Fereindun Feizollani -- I'm really getting tired, I'm sorry if I mispronounced his name. Fereindun Feizollani, did I get that right? Yeah, there he is, thank you, Fereindun.

And Chang Sung, who is working with Peter Berck on his economic modeling. Thank you, Chang.

On our side we have a number of people in the room I'd like to recognize. Most importantly, my lead people, Dan Fong. You've heard a lot from Dan this afternoon. Dave Ashuckian is in the back of the room. Gerry Bemis. McKinley Addy who has done some of the work on the advanced natural gas engines and the high efficient diesel engines for heavy duty vehicles.

Bill Blackburn who has the lead on fuel cell technologies. Bill, I think a lot of you know him from the California Fuel Cell Partnership. Sherry Stoner is our assistant project manager, has been invaluable in helping us pull together these events.

I have in the back, I think, Tom McDonald in our fuels office, who has the lead on the ethanol related strategies, with assistance from Gary Yowell. Gary, are you still here?

And if I've missed anybody I apologize, it's been a very long day and it was a long day yesterday, getting ready for this workshop. So, again I want to thank everyone for their participation.

Commissioner Boyd, do you have anything you'd like to add.

COMMISSIONER BOYD: Yes, thank you, Susan. I want to add to my appreciation to everybody for their comments, and the additional information you put before the staff today, as kind of the new guy on the block for this subject, but really not a new guy on this subject.

I found this quite interesting. A lot of good suggestions for the staff to take into consideration in their deliberations on this subject as they complete their analysis and bring forward their reports.

And I'm just going to caution the staff, at least of the Energy Commission, and mention to everybody in the audience, we really need to put this into context of the whole system.

Some of you were in the audience last week when we had a workshop like this on MTBE phaseout, which really became another workshop on the future of petroleum as a transportation fuel. You can't get away from it.

The Energy Commission is involved in other studies, petroleum reserve studies pipelines studies, what-have-you. They all interact. They're all part of the bigger system that we need to deal with with regard to transportation fuels, and in general, not just the use of petroleum as a transportation fuel, but to meet our transportation fuel needs. And that becomes more and more of an issue.

But I've seen in the what, three weeks I've been here now, particularly last week's workshop on MTBE. I'm sorry if you weren't here that you weren't here, because these are becoming another chapter in a continuing series of this overall debate of dealing with this system of providing adequate transportation energy, let's just say, to keep the California economy going and growing.

And for us to deal with the supply and demand issues relative to these fuels. Supply augmentation and/or demand reduction is something we have to deal with. And painful lesson from last week's workshop, or let's just say another wake-up call, I won't call it a painful lesson just yet, was that notwithstanding efforts to, let's say, phase out MTBE or to reduce our dependence on petroleum as a transportation fuel, the issue that Mike brought up in his second slide of a demand line going virtually out of sight; a supply line current California refining capacity, and I didn't hear, haven't heard anybody for a couple of years say that there's any ability to increase that. There might be, but nobody's willing to say that there is.

And a huge delta. And in between it's, you know, it's reduce demand, it's import refined products, it's fuel displacement. And yet last week we heard pretty significant testimony on the inability in this day and age and future day and age of finding additional product to even import.

So, to deal with the nation-state of California and its fuel needs, and to start finally taking into account the high value demands being put on what you get out of a barrel of petroleum, and where is the best use of that barrel. We're not going to diminish our use of that diminishing resource. It's a question of what is the best use of that resource. And what is the best use of other alternatives.

And the transportation area remains as it has been for as long as the gentleman from SunLine Transit said it, or former Presidents might have said it, of a very large arena in which we need to operate.

So, as well as just looking at this narrow stovepipe question of reducing dependence on petroleum, we really need to look at how we respond to the needs of the California economy.

And it's going to be, in my mind, you know, demand reductions through VMT reductions; demand management, fuel economy, mode shifts, price mechanisms to make sure we don't increase the demand. As well as maximizing or dealing with the question of imports of conventional fuels. And then looking at nonconventional fuels.

To me, it's going to take all of those to meet these demands that people keep showing us that we're going to have to deal with. Even if we tilt down that demand, in my mind, we don't have enough petroleum, per se, to meet the transportation sector's energy needs.

And this is just more evidence to the

fact that it's time to go around that circle again with regard -- that we continue to go around, with regard to what are the various options, what are the various alternatives, what can we do to address these problems.

So, welcome aboard to what I see as a very long term project dealing with our energy needs in this state.

One other comment or two, I think Rick McCann made reference to a few things about -- I don't see him out there any longer, but things that I do agree with, and I don't agree with, as one of a few people in this room who've lived through the electricity crisis and allegations of market power, I don't want any midwestern hypodermic needle in my arm, either, when it comes to ethanol.

But we have to deal with the market as it is. I don't agree that biomass isn't a potential in this state for the production of ethanol -- oh, there you are, Rich -- I --

DR. McCANN: I'll send you the report.

COMMISSIONER BOYD: Well, I still think there's a greater potential, but it isn't going to answer everything. I'm not one to be real enthusiastic about energy crops, either. But I think there's potential in that arena.

And I think there's potentials for dealing with some of these other issues, as well.

But I see room for everybody in the room here with regard to what it is that they happen to favor, or what the potentials are.

And I've never lost my fascination for electric automobiles, either, so. Anyway, thanks to all of you, and look forward to working with you on this long-term project.

MS. BROWN: I would be remiss if I didn't also recognize Cynthia Praul, our Assistant Executive Director. And on behalf of the team I want to extend special thanks to Mike Jackson and Nalu Kaahaaina of Arthur D. Little, who have the challenging task of integrating all the pieces of this analysis into a cohesive document with our input.

So, Mike and Nalu, thank you for your many long hours of professional work.

So, with that, this workshop is adjourned.

(Whereupon, at 3:52 p.m., the workshop was concluded.)

CERTIFICATE OF REPORTER

I, PETER PETTY, an Electronic Reporter, do hereby certify that I am a disinterested person herein; that I recorded the foregoing California Energy Commission Workshop; that it was thereafter transcribed into typewriting.

I further certify that I am not of counsel or attorney for any of the parties to said workshop, nor in any way interested in outcome of said workshop.

IN WITNESS WHEREOF, I have hereunto set my hand this 8th day of March, 2002.

PETER PETTY